1962

Approved For Release 2004/01/16 : CIA-RDP75B00285R000400040001-3

22 March 1962

Dear Don:

It is a good idea about this time to summarize where we stand on the development of our A-12 escape system and, incidentally, to compare it to the B-58 capsule, which is currently being tested.

STATINTL

Enclosed is a USAF report, composed by the Air Safety Group at [redacted] The conclusions of this report fully substantiate the stand that I have taken for a long time, that capsules are not the desirable system, nor are they really necessary, for escape from aircraft similar to the A-12 and the Century Series Fighters in performance. Certainly, some day we will probably use capsules for escape from satellites, but, to this point, I have found little reason to change my thinking in regard to escape from manned, winged aircraft.

The other day I reviewed, also, the 1961 summary of escapes by means of ejection seats from Navy and Air Force aircraft. There is still a lot of work to be done to improve the reliability of existing types of ejection seats and parachutes, a great deal of which I think we have accomplished on the A-12 system. You are well aware of our tests, which have demonstrated safe escapes at air speeds as low as 65 knots on the ground up to Mach numbers of 3.2 at [redacted] STATINTL The above mentioned Air Force and Navy reports, however, emphasize again that the vast majority of ejections from current day service aircraft are at altitudes under 5,000 feet and air speeds under 300 knots.

The emphasis which we have placed on trying to get to a zero velocity escape system is well known to you. There is little evidence that escapes from very high altitude and Mach numbers are required. Of course, because of the A-12 mission, special circumstances apply and fortunately, working with you people, we have been able to come up with an excellent all-around escape system.

We have made a comparison of the A-12 escape system and what would happen if we put in the B-58 capsule. It should be noted that, first, the fuselage cross section is increased 3.7 square feet, and the fuselage must be 6 inches longer, with the capsule. Taking the very most favorable approach for the capsule, the empty weight of the aircraft is affected as indicated below:

B-58 Capsule + Man	695 lbs.
A-12 Seat + Man	421
Difference	274 lbs.
Structural Revisions Necessary	275 lbs.
Total Additional	559 lbs.

This weight estimate to install the capsule is probably on the light side, in that no allowance has been made for fore and aft fairings, additional basic fuselage structure to carry this heavier load, the fuselage structure to absorb the heavier catapult reactions upon ejection, and the control system changes to get the stick inside the capsule.

We have made a rough estimate of what the added empty weight and drag would do to the A-12. As you know, to carry the added empty weight the same distance would require an increase in gross weight of 3930 pounds, and the cruising ceiling would be reduced by 1300 feet. These performance reductions would be totally unacceptable. Furthermore, I feel that the B-58 seat is so complex that I see it leading to accidents and fatalities rather than reducing them. For instance, there are 15 safety pins which must be placed in the B-58 capsule for safety on the ground. There are somewhere between three and four times as many explosive initiators on the B-58 as on our seat.

Of operational interest are the attached pages from the B-58 and the A-12 flight manuals. You will note the B-58 warning on use of the capsule at low levels; whereas we feel confident of escape success at 65 knots on the runway. I know of no other flight manual that states this.

As a result of our program to date, we have:

1. Proven low level capability from 65 to 300 knots on the runway. Slower speeds will be checked at the conclusion of parachute tests.

2. Accomplished sled runs at Edwards AFB. Five runs were successfully completed, encompassing 109 to 450 knots, in seven weeks. This attests to the reliability of the over-all ejection system. I know of no other program which has been completed at Edwards in less than six months.

3. Developed and qualified new parachute timers, which produce 220 lbs. pull on the pins. This is a much needed piece of hardware, which will probably be used in other USAF parachute systems.

4. Developed and qualified a speed sensor, which is the heart of low level capability. This permits .6-second seat-man separation below 300 knots and 2-second seat-man separation above 300 knots.

5. Proven 35-foot canopy operations for slow and high speed ejections. This provides crew member safety on landing.

6. Accomplished wind tunnel runs to Mach 3.2 on 60- and 78-inch drogue parachutes for high altitude stability use. See report enclosed. These drogues are structurally proven but to date have not consistently stabilized a free-falling dummy. Live jumps are to be used to evaluate the seriousness of this problem.

7. Developed and qualified ejection seat pyrotechnic devices for high temperature environments. These devices and their related charges will undoubtedly become USAF inventory in time.

In summary, I believe we have provided a very advanced escape system in the A-12, which should be adapted to many other types of aircraft, and I am sure that its safety record will be substantially better than that of capsules similar to the one in the B-58 or the [redacted] proposal.

STATINTL

Incidentally, we have studied capsules quite completely, and I am attaching a copy of the F-104 study recently completed for the Air Force.

We have one remaining problem, of which you are aware, which is the dummy stability problem when free falling on the drogue chute. We do not believe this to be major, and expect to solve it shortly.

Sincerely,

Kelly

Attachments (5)

SUBJECT: INTERIM REPORT ON AEROMEDICAL PROTECTIVE EQUIPMENT

19 May 62

This report is an attempt to give in summarized, narrative, but preliminary form the description of the functions and current status of all the environmental control, escape and survival systems for the program concerned. A subsequent report will concern itself in more detail with the actual production specifications, production dates, and unit costs. The systems are divided into their component parts thusly:

1. Ship-Mounted Pneumatic and Oxygen Controlled Equipment:
   - A. Oxygen Control Panel Assembly
   - B. Disconnect Assembly, Suit Ventilation
   - C. Bracket Support, Vent Valve
   - D. Indicator, Oxygen Overboard
   - E. Valve Assembly, Filler
   - F. Disconnect Assembly, Oxygen, Dual
   - G. Gage, Dual, High Pressure (0-2000
   - H. Pressure Reducer and Oxygen Cylinder Assembly
   - I. Valve Assembly, Self-Checking
   - J. Cylinder, High Pressure
   - K. Warning Light, Depleting Oxygen Supply Pressure
   - L. Bracket Support, Pressure Reducer
   - M. Clamp
   - N. Valve Assembly, Suit Ventilation
   - O. Pressure Reducer Assembly.

II. Suit, Full Pressure
   - A. Helmet Assembly
   - B. Helmet
   - C. Regulator, Oxygen, Dual
   - E. Exhalation Valve, Single
   - F. Garment Assembly, Full Pressure
   - G. Garment
   - H. Mounting Ring
   - I. Deflector
   - J. Mounting Hardware
   - K. Disconnect
   - L. Suit Controller, Oxygen, Dual
   - M. "O" Ring
   - N. Disconnect (undersuit)
   - O. Hose Assembly, Suit Controller
   - P. Hose Assembly, Suit Controller

III. Maintenance Van
   - A. Basic Van
   - B. Altitude Chamber
   - C. Test Stand

F. Bio-medical Instrumentation
G. Oxygen Manifold

IV. Transport Van
A. Basic Van
B. Ventilation Console
C. Pilot Console
D. Oxygen Manifold
E. Suit Test Kit
F. Ventilation Pack
G. Breathing Pack
H. Auxiliary Power Unit
I. Intercom System
J. Pilot Chairs

V. Ready Room
A. Lounge Chairs
B. Ventilation Console
C. Intercom System
D. Pilot Console

VI. Escape System - Ejection Seat and Parachute Assembly
A. Ejection Seat
B. Actuator Pack
C. Parachute Pack
D. Drogue Release
E. Pad, Kidney Support

VII. Emergency Oxygen System

V111. Seat Pans, with Survival Kit

In accordance with over-all program philosophy, a basic design concept has been complete duality of function. This includes the dual breathing regulator, dual suit controller, complete duality in the panel-mounted oxygen control unit, ship's oxygen supply, as well as support hardware such as disconnects, lines, controls, and emergency oxygen supply.

Qualification testing of the oxygen system components consisted of a series of functional tests performed before, during and after environmental testing of the oxygen package.

I. <u>Ship-Mounted Pneumatic and Oxygen Controlled Equipment</u> - all qualified, with the exception of the oxygen control panel assembly and the disconnect assemblies.

A - Oxygen Control Panel Assembly - presently this is a soft-seat assembly. Plans are being made to change over to a hard-seat assembly, primarily as a result of a recent on-board aircraft fire, (not related to this program). This change will require field retro-fit and will require re-qualification. The ship's oxygen control panel assembly is mounted at a convenient location on the left-hand side of the cockpit console. The panel, completely dual, consists of two oxygen supply "On-Off" valves and two low pressure gages enclosed in a single housing. The "On-Off" valves provide flow/no flow control of the ship's supply of oxygen from the oxygen supply cylinder-reducer assembly through suitable tubing to the ship's quick disconnect. The "On-Off" valves also provide the crew member with a secondary oxygen supply depletion-balance control; i.e., if one of the supply cylinders shows an excessive depletion rate, as compared to the other supply cylinder, the reducer in the rapidly depleting system can be turned off until the pressures in both systems are equal. The primary depletion control is automatic, but may vary due to some slight mechanical condition. The low pressure gages, connected independently to the low pressure outlet side of the high pressure reducers, provides a direct reading of the oxygen pressure delivered to the helmet regulator.

B - Disconnect Assembly, Suit Ventilation - requires possible change-over to a spring-loaded probe device because of anticipated difficulties with the seat pack rolling over and forward upon ejection and preventing the man from successfully leaving the aircraft in the event of emergency ejection. This will require re-qualification. The ventilation disconnect, an integral part of the vent system is mounted on the crew member seat, and provides automatic separation from the suit vent system. Vent system separation occurs automatically during pilot normal "stand-up" movements for ground emergency evacuation and automatic lanyard controlled separation occurs during in-flight emergency seat ejection. A check valve is incorporated into the suit half of the disconnect to prevent loss of suit pressure at disconnect separation and also acts as a water check valve.

C - Bracket Support, Vent Valve - qualified. This is attached to the seat, to hold the ventilation hose in position relative to the seat.

D - Indicator, Oxygen Overboard - qualified, contains a disc which will blow if the burst disc blows, to prevent internal rupture and/or contamination of the oxygen system.

E - Valve Assembly, Filler - qualified. This assembly is used in servicing the ship's oxygen bottles.

F. Disconnect Assembly, Oxygen, Dual - requires possible change-over to a spring-loaded probe device and will require re-qualification. Oxygen from the ship's supply is conducted through the "On-Off" valves to the ship's supply. The disconnect is presently mounted at a position on the front of the crew member's seat, permitting ease of personal oxygen hose attachment and allowing vertical seat adjustment. However, because of considerations referred to in (B) above, possible changes are anticipated. Presently, attachment of the personal oxygen leads or hoses to the oxygen disconnect assembly is accomplished by simple alignment of the leads to the disconnect and pressing into place. Engagement of the leads into the disconnect mechanically locks them into this position and automatically opens a check valve in the disconnect allowing the oxygen to flow to the suit controller. This check valve cannot close and cut off oxygen supply except by separation of leads from the disconnect. Manual disconnect separation can be accomplished by pulling up on the oxygen leads. A pull of approximately thirty pounds is required. The disconnect is also equipped with a lanyard operated separation mechanism. By attaching the lanyard to convenient aircraft structure, the ejection of the seat during emergency aircraft abandonment will automatically separate the crew member from the oxygen disconnect and ship's oxygen supply. Check valves incorporated into the crew member's personal oxygen leads automatically close to prevent loss of emergency oxygen through the separated leads. The ejection bailout action reacts upon a guided cable to the emergency oxygen system, causing the emergency oxygen to be turned on providing the crew members with an uninterrupted supply of oxygen.

G. Gage, Dual, High Pressure - qualified. The dual high pressure gage is connected independently to the inlet side (high pressure) of the oxygen high pressure reducers and provides a direct reading of the pressure of oxygen stored in the supply cylinders. The dual high pressure gage is enclosed in a single housing and is mounted on the left-hand side of the cockpit instrument panel.

H. Pressure Reducer and Oxygen Cylinder Assembly - qualified. The two high pressure oxygen reducer valver, connected independently to the oxygen supply cylinders, reduces the outlet pressure of the supply cylinders from the stored pressure of 2000 PSI (max) to a minimum delivery pressure of 66 PSI at 100 LPM flow. Flow passages and arrangements of internal parts are such as to maintain delivered pressures without appreciable pressure drop during any conditions of demand, including maximum obtainable flow volume of the helmet breathing regulator. The contractor has been asked to place an "on-off" valve on the reducer for re-filling purposes. Requalification is not required.

I. Valve Assembly, Self-Checking - qualified: mounted to the reducer and screws into the oxygen bottle. A safety burst disc is incorporated into the outlet port of the oxygen supply cylinders.

The disc serves as a maximum pressure relief valve to prevent a hazardous pressure build-up in the supply cylinders due to an abnormally high temperature condition.

J. Cylinders, Oxygen, High Pressure - qualified. The oxygen supply is contained in two stainless steel cylinders with a single cylinder volume equal to 875 cu. in. (1750 cu. in. total capacity, 2 cylinders), and a service pressure of 2000 PSI at 70° F. Only one bottle has been proof tested by the contractor to date. These bottles are not shatter-proof to gun-shot.

K. Warning Light, Depleting Oxygen Supply Pressure (Switch, High Pressure - qualified. Two red warning lights connected through two pressure sensitive switches to the oxygen supply cylinders will turn on the warning lights whenever the stored oxygen pressure in either cylinder decreases to 400 PSIG. The warning lights are mounted on the main instrument panel in the cockpit.

L. Bracket Support, Pressure Reducer - qualified.

M. Clamps - qualified

N. Valve Assembly, Suit Ventilation - qualified. Thermal protection is provided by the controlled flow of ventilation gas through the suit. The ventilation control valve, mounted on the left-hand console, is a variable flow valve enabling the pilot to manually adjust the flow of ventilating gas from the ship's supply to the suit. - suit-mounted

O. Pressure Reducer Assembly - qualified. A spring-loaded relief valve is installed on each reducer. Its function is to prevent excessive pressure build-up in the system due to leakage across the reducer valve when the system is not in use. The valve is set to relieve at a pressure between 120 and 140 PSIG.

II. Suit, Full Pressure: none of the suit hardware has been qualified, although the suit and its components are considered in good operational condition, and in its entirety qualified by similarity. The suit system, together with the conditioning system, will maintain thermal and respiratory balance for the pilot and provide emergency protection against extremely high temperatures, wind blast and decompression. During normal flight, the suit is not pressurized and not restrictive to movement. The suit ventilation system maintains comfort under the gas-tight and insulated clothing assembly. If a decompression situation should occur, the suit offers complete pressurization while ventilation and thermal protection continue unchanged. Movements will be somewhat limited when the suit is pressurized but not enough to hamper necessary actions of the pilot. Altitude chamber runs, simulating mission profiles of temperature extremes as well as altitude limits, have been used in the sophistication and preliminary qualifications of the suit.

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The suit controller is a combination high-flow, low-resistant valve provided to regulate and maintain suit pressure. The vent section of the valve uses a compensation diaphragm and aneroid controlled back-pressure to maintain absolute suit pressure. The suit controller, mounted on the right hand side of the suit, is a completely dual unit, enclosed in a single housing. The controller automatically maintains these constant absolute suit pressures: primary system - 180 mm Hg.; secondary system - 170 mm Hg.; subject to variations in pressure permitted for ventilation and allowable suit leakage, whenever an atmospheric pressure of 170 mm Hg. or less is reached. The controller maintains the necessary suit pressure by controlling the back pressure of the ventilating gas. If the vehicle ventilating gas supply system becomes inadequate or is lost, the demand section of the suit controller will automatically supply gas pressure directly into the suit from the oxygen supply system. The normal aircraft oxygen supply and the emergency supply systems are connected to the suit controller to insure suit pressurization under all flight conditions. A water check valve is provided in the controller to prevent the flow of water into the suit when submerged in water.

The oxygen flow tester is an integral part of the suit controller. It can be readily reached with either hand and is so designed to minimize its unintended operation by hand or arm movements. The manual oxygen flow tester enables the crew member to in-flight or ground check the suit controller operation. The press-to-test is activated by pressure of the crew-man's finger; the result of this action is to create artificially a demand condition within the controller corresponding to that which would be encountered at high altitude.

The action causes suit pressurization and a corresponding increase in oxygen flow to the helmet regulator.

The breathing regulator, mounted inside the helmet, is a dual demand type regulator actuated by a spring-loaded diaphragm that is referenced to the suit pressure to maintain a positive breathing pressure over any given suit pressure. The regulator supplies the pilot with breathing oxygen from the ship's system during normal operation and from the emergency oxygen supply during any emergency requirements. A variable orifice is incorporated into the dual regulator to facilitate equal depletion of the dual ship supply or dual emergency supply of oxygen.

DCO 15 October 1962

Personal Equipment

1. Between 20 Sep 62 and 7 Oct 62, I visited on two occasions each the David Clark and Firewel Companies. In general I obtained a good working knowledge of the suit, helmet, parachute package and oxygen system. I was able to put on a production suit similar to the one we will have and wear it under pressure. In a previous TDY I was able to wear the Goodrich Mark IV suit used by the Navy. At Firewel I also observed chamber runs by users.

2. In general, the equipment appears adequate for the mission. Personnel in both companies are courteous and helpful. The training program at Firewel probably suffers from being too informal. While everyone is given a general knowledge of the equipment, details (as suit controller, helmet oxygen regulator) are furnished only if requested. There are no schematics available showing the function of the system (for example, what actually happens to make the antisuffocation feature work). My criticism may be unwarranted, because the two users I was with, both quite intelligent and well trained, expressed no interest in knowing these details. However, I would have preferred a somewhat more formal approach using charts and other illustrations. It would seem to me, particularly with new design equipment, that some knowledge of detail is necessary to understand and possibly correct unforeseen malfunctions which may occur in flight.

3. The chamber runs were well organized and executed. However, although the proper seat is used, there is no cockpit mockup. Therefore, mobility of the suit under pressure cannot be tested against flight requirements. For example, are all controls accessible under 3.5 PSI? Are switches and levers so designed that identification and manipulation are easy with gloves inflated? The exygen gauges and switches should be located as in the cockpit. A mockup with actual cockpit lighting should be available to check possible reflectance problems of the visor. While Firewel has just received a set of cockpit dimensions and reach distances, this is obviously not the best we could do.

4. One problem that I feel deserves further study is the question of oxygen flow with visor open. Normal 02 consumption will vary from about 5-15 liters/minute. With the system ON, opening the face plate results in a flow of about 130 liters/minute. In asking why this was so designed I received the following possibilities:

a. It was done thus in the previous program using a partial pressure suit.

b. It will help prevent dysbarism by furnishing oxygen when the visor is open.

c. It acts as a deterrent to discourage opening the visor.

d. Space limitations in the visor opening know preclude incorporation an ON-OFF valve.

With respect to these possibilities:

a. "A" has no validity.

b. "b" May be a good point, but no tests had been conducted to determine whether time of useful consciousness is significantly prolonged. These tests would be simple and inexpensive. I suggested that they be performed.

c. "c" is like building in a fuel dump valve which pumps overboard if the pilot violates certain rules. Properly, the pilot should be trained not to open the face plate, rather than be penalized if he does.

d. "d" is a problem for the designers if a requirement exists for the ON-OFF function.

5. In my opinion, the oxygen supply to the spray bar should automatically turn off when the face plate is open, unless it can be shown to have significant value in prevention of anoxia. It is easy to visualize situations where the visor may need to be raised; for example, Navy experience demonstrates visor reflectance problems particularly at night. Some pilots must raise the visor for night landings. For night réfueling, it may be essential to raise the visor. Loss of a large amount of oxygen will occur unless the main ON-OFF switch is closed. This is highly undesirable because in the event of decompression the supply must be turned back on, in addition to dropping the visor, at what may be a critical moment.

6. One other area which deserves further study is the matter of rapid ground egress. Necessary steps include releasing foot retainers, disconnecting lap belt, pulling seat kit release, unfasting parachute releases, and disconnecting parachute emergency oxygen lines (2). One of these, the "left", is so angled where it enters the suit controller that it is difficult to manage even under ideal conditions. I have no ready recommendation for corrective action here.

Dec 62

10 bottles 2000 psi

drop test 10' to concrete

c-45-85

STATINTL

3000 lb 6000 lb proof

[redacted] - 2500 lbs. - 1200-1800/system

will require new high pressure gauges + switches.

1800
2400 } 1/3 d longer ↓ 26 1/4 28 1/4 82°

12 L/min. Face seal leakage

18-20 L/min - 2 Co drivers

At Fire area 9-10 L/min.

30" ground time

13 hrs Never spelled out - 75 cc in bottle.

Ed wants superimposed - 9 1/2 hours.
system.

Minimum 9 days.

Lamtex - Can't do it. quoted Rubber.
Riverside Plastics - pre engineering & effort.
parachute bottles.
cut 2 lbs off wt of back pack.

Lamtex - plans for holding bottles in
back pack - 3 mos delay.
Medney - Time - looks fairly good.

Time for development -
Ambient Temp - 400°
What Temp actually see.

30-40 m.

* Taken out considerable amount of
thermal protection.

Max leak rate 4 L/min 1.4 L
Factory 2 L/min.

Dual regulator (breathing) –
Are doing work on this in
attempting to solve dual isobaricity
of the 2 oxygen systems.

5" max wall temp. – 400 °F

Teflon tape covers to prevent water condensation

5 - A-12 a/c ordered (A class)
Aro - Ship mounted hardware
Mated APS 22/S.2 can be done
requires manual switching.

Recap.
3 hard seat assemblies -

4-4½ hrs - spread of 100 psi

Eastham - only 1 day at Farewell.

Vent-cashed valve mounted on suit now -
couldn't reach it. Now mounting a
Water check valve - spring loaded.

F. Disconnect - assembly, Oxygen dual.
sealing has improved
increased pull force

H. on off valve incorporated -
Metallic valve

32,500 3.88 6.5

74,000 .53 3.3

5 m/s

6 psi

7.4 psi 90 m/s

34,000

0 - 26,000 5.22

3.5

APS 22/S2

S-T AF single

S901 0 duality

[redacted] STATINTL

[illegible]

[redacted] STATINTL

AF-A12 - ordered 9 - Templeton

STATINTL [redacted] only 1 fitted

13 Dec 62 Lockheed

STATINTL [redacted]

Chute System

15,000 ft
> 385 K
} beyond these, 75% reliable.

450 K IAS - aircraft limit.

Aim for low speed low altitude capability.

Since mods done at area.

factors
1) fouled harness.
2) timer case distorted.
3) Main canopy timer failed
4) Main canopy deployed prematurely due to pin access failure.
5) Survival kit - fouling.
6) Teflon (drogue jettison) housing.

Current fixes

A. B. C. are buffed up.
1 2 3

4.

Ship - hit surfaces 0 - 56, 5700 psf
built up, accelerations

Difference in Standard - B-5 - slower slope of
force build-up.

Worse force build up 20-22 G's
70 K & Mach 3.2.

Dampening effect of pressurized suit.

? how much time in critical areas

? what value is the survival kit.

Can it be reduced in size.

40 lbs -

reduce size or shape or packing.

Bruce - ground egress - single emergency O_2
system.

Leak out of emergency system into
ship's supply.

Approved For Release 2004/01/16 : CIA-RDP75B00285R000400040001-3

15 M Further Parachute Testing

A - High speed 13-66 tests Jan El Centro
- 4 drops @ 385 knots 20,000 ft.

B - Ground ejection tests Fico area
check B.66. 6 ejections @ 65 knots before 15th

C - In-flight ejection F106 Mar El Centro
1. 400 K 46,000
2. 450 K's 53,000
3. 385 K's 50,000
4. 450 K's 20,000
5. 60,000 +

Accelerometers.

STATINTL [redacted] - indoct.

Temperature profiles 400° Radiant
225° Air
normal operating temp. - 285 Radiant.

Test equipment to max -

Reflectance characteristics of face plate.

Dr. McNeill of AO Scerrari - l.15

laminates.

Shep: Liberty mirror + conductive coating on visors? - can't make it.

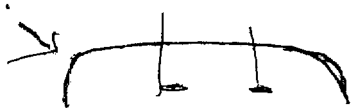
↓

Flash blindness — NCR.

Sierracin — only ones who have successfully gold coated a curved surface

Pittsburgh Plate Glass — wired grid in tempered glass.

? willing to experiment on plastics laminate.



82-85% light transmission
vs
70%

Much better than MA-2 visor.

STATINTL

~~Fac 3~~

~~3-4 Jan.~~

ILLEGIB

STATINTL

[redacted]

[redacted]

28 Dec 62

West-Coast trip folder

STATINTL

Dear [redacted],

PD

Per your request, here are some areas of concern to us:

1. Oxygen system;
   - a. Difference between chamber consumption and flight consumption data. Have studies of face movement affect on consumption (leakage around face seal) been completed? — held up because of rejects on helmet.
   - b. Current status on means of equalizing consumption between systems 1 & 2 so will bleed down together?
   - c. Temperature of oxygen at spray bar? (Uncomfortably warm in chamber at max temp. Will it be same in flight under max temp conditions?)
   - d. Have received only two of the new oxygen lead hoses. Not ready used on new suit
2. Helmet:
   - a. Satisfactory fix yet on antisuffocation device?
   - b. Status of reflectance problem? [redacted] helmet STATINTL
   - c. Have clip-on visor for only one helmet. Finger grip does not work. However, can remove by placing fingers under rear of sun shade. Might as well remove finger grip since useless.
3. Suit: Need water check valve on suit side of vent disconnect. in work As is, will flood suit on water landing.
4. Shoes: Flat, smooth sole on one pair has been suggested by Hq to decrease tracks. Your comments?

E & E

5. Survival kit:
   - a. We still do not have winter equipped. — HQ FUNCTION, BUT DELAYED BY ?
   - b. What is status of getting ~~xxx~~ sleeping bag compressed to fit?
6. General:
   - a. What are your thoughts on water of food during flight? Have you ruled these out because of dysbarism factor? –
   - b. Bates feels adaptation of 101 for suit practice is possible. Says vent can furnish 6 cfm at 70° and this should be satisfactory for up to 90 minutes. Please ask Bob Z. for statistics on his evaluation of this. We are inclined to feel benefits derived not worth it, but at least one user thinks would be very valuable training.
   - c. While not involving your present trip, other matters of concern:
     - (1) Difficult if not impossible for firefighters to disarm seat (first step in ground rescue).
     - (2) If canopy fails fire in normal ejection sequence, seat cannot be fired, even if canopy successfully ~~xx~~ jettisoned manually.

4 - 10.12 after

stepping down

Sincerely,

[redacted]

STATINTL

1963

March 4, 1963

To: Colonel Jack Ledford, USAF
Office of Special Activities

Subject: Miscellaneous items for the record

STATINTL 1. [redacted] are scheduled for Albuquerque on the 3rd, 10th and 17th March, respectively.

2. The instructional material and methods used in conducting the ground school are the subject of considerable discussion and differences of opinion. The subject merits an early unbiased review and evaluation prior to the attendance by additional operational personnel.

3. A temporary delay has been set in the procurement of additional equipment check-out trailers. Previous specs which allowed 10 foot wide trailers are now claimed as unacceptable since that width cannot be fitted into either the C-124 or C-130 transports. Clarification is needed before the supplier can proceed.

4. Bioelectronic monitoring equipment for use during training flights to determine physiologic variables and O_2 usage rates are unlikely to be available unless the project is added to those open AF programs now underway at UCLA and Edwards Air Force Base.

5. Operational personnel do not concur in my statement that current approved manning tables (for aeromedical unit) would be adequate to cover both Field Station and Satellite operations. Further experiences at field station should clarify this point.

6. Kelly states that aeromed personnel are requiring one STATINTL hour for cockpit installations and check-out, and this time factor is unnecessary and unacceptable. This matter is being investigated by [redacted] and will be reported upon.

7. Current experience on oxygen usage rates is inadequate to finally judge the duration of the system. Evidence from ASD, ADC

and Navy use of FPS indicates an average usage rate of 20-25 liters per minute. Using this figure, the current capacity provides approximately 7.5 hours of use. Extension of O_2 bottles by 6.5 inches and increasing the bottle pressure to 2800 psi will provide a 12 hour supply at 23.45 lpm. The prime contractor has agreed to th modification and the supplier has been notified. Time required obtain the new system is between 10-12 weeks. If difficulties in using this greater pressure in the system, the larger bottle 2500 psi will provide 10.5 hours usage. The supplier has agreed notify the contractor and OSA early this week regarding dates and costs involved.

8. In response to my query re the assignment of the C-130 to the Station, the answer was given that the date of its arrival was about as indefinite as it had been in the past. I mention this only in reference to our statement to the contractor made 2 months ago that a C-130 would shortly be available for use in emergency air evacuation of serious personnel casualties. Accepting the fact that, if and when the C-130 does arrive at the area, it will seldom be on station for emergency medical evacuation, I would recommend that the AEC C-47 be supplied with 12 litters, brackets and straps plus in-flight emergency medical and surgical equipment. Further, I recommend that once monthly a simulated exercise be conducted in which the litters are erected in the C-47 aircraft and simulated casualties actually be loaded and unloaded aboard the aircraft. I seriously doubt that the Connie could be used for such purposes in its present state and unless suitable secure litters could be rapidly installed I would urge strongly against its use to transport seriously injured personnel sitting up even though the panic button is pressed.

[redacted] STATINTL

rjl

March 4, 1963

To: Colonel Jack Ledford, USAF
Office of Special Activities

Subject: Status report on aeromedical protective equipment resulting from conferences held 27, 28 February, and 1 March, 1963.

1. Pilot performance and comfort in the suit seat assembly:

a. On the basis of 20 missions to date carried out while wearing the full rig, it is generally agreed that with minor alterations, all requirements for operator performance, as presently delineated, can be adequately met. It was realized that a final judgment could not be made until training missions of the exact duration and complexity as those required were completed; yet the consensus of opinion and judgment on the part of those primarily involved was that the equipment, as currently developed, presented no serious problems.

b. As an order of priority the following items were listed as constituting the major modifications requiring satisfactory resolution during the ensuing 12 week period.

i. Elimination of the reflections of the face in the internal surface of the face plate of the pressure helmet. This presents a serious problem during refueling hook-ups particularly when the intensity of incident light into the cockpit is high. Evidence thus far does not indict the metallic coating (de-fogging) on the face plate as being the primary factor and the best fix to date has been the blackening of the skin by various means. Continued work will be carried out to elucidate the factors involved and effect the proper remedies. Meanwhile, a satisfactory method of darkening the face either through applications to the skin or by wearing a black face mask will be attempted.

ii. Individual pilot position and comfort will be provided through the use of cushions, pads, positioning of the seat and back pads and through the provision for more latitude in the adjustment of both the seat and the rudder pedals. The control stick is said to be too high and the grip too thick for comfort and optimal control feel wearing gloves. The contractor is providing shorter control columns (by 2") for evaluation and is investigating other available grips which could contain the same number of controls but would be less thick and bulky in the hand.

iii. The helmet hold down assembly currently allows a one-handed operation for cinching down prior to pressurization, but requires a 2 hand operation for release. This is undesirable during training and test procedures and will be corrected by reduction of fabric friction component and modification of releasing mechanism.

iv. Manual pressurization of suit assembly during training flights requires the continual use of one hand on the PTT button, which restricts pilots ability to evaluate problems of control and mobility ensuing after suit pressurization. Suit controller will be provided with a simple slide latch enabling pilot to maintain suit pressurization for time period desired without having to maintain pressure on the PTT button.

v. The internal pad which suspends the helmet by pressure on the crown of the head is felt to be too small, causing discomfort to the scalp and head. It was generally felt that if a greater area at the top of the head could be used by the contact pads without compromising the required ventilation flow to the head, considerable improvement in comfort and lessening of fatigue would be gained. Various types and configurations of materials will be given a field test and evaluation toward improving this situation. As an ancillary item on this matter of helmet comfort, the topic of ear doughnuts was raised as being unsatisfactory in their current configuration. Careful analysis of complaints did not lead to either specificity of the defect involved or unanimity of opinion regarding the seriousness of the problem. The best estimate thus far made is that if the helmet hold-down strap is not pulled part-way down before the PTT button is activated, the helmet rides up so far that the ears come out of the doughnuts. After the pressurization test is completed then in some cases the ears cannot be repositioned into the comfort circle of the doughnuts. Larger-sized doughnuts will be evaluated as well as indexing each individual hold down strap at a point which would keep the helmet from riding too high after the PTT button is activated.

Ejection seat and parachute assembly.

a. The results of all past tests with the parachute seat assembly were reviewed in detail with the concurred opinion expressed that with the exception of the possible heat problem after ejection at one brief point on the mission profile, the assembly provides a degree of safety and reliability equal to or greater than that which exists currently in any high performance aircraft. As a result of the last high "Q" tests performed at El Centro, the timer delay for seat separation under altitude, high speed conditions will be increased from 2 seconds to 4 seconds, which will reduce opening shock loads of the drogue from 17 to 11 G's. The rocket jet releases are being modified to prevent accidental opening under high "Q" conditions. Four additional dunning drops are scheduled for 1 April to check out these modifications and these will be followed immediately (o/a 15 April) by the truck tests at the area and the F106 ejection seat tests at El Centro.

b. The mechanism involved in canopy and seat ejection was the subject of considerable discussion, with no ultimate resolution of the problem being reached. The principal point of argument evolves around the lack of a back-up initiator capable of manual use to blow the seat in the event the canopy fails to eject after pulling the "D" ring and is manually blown after malfunction of the standard mechanism. There are many pros and cons to this argument and all agreed that the entire situation requires further study and evaluation. My personal opinion is that there are a few people involved in this problem who basically are neither technically or operationally qualified to discuss and evaluate the problem, let alone have a voice in the final decision.

c. The basic features of simplicity and reliability are of paramount importance in any ejection seat mechanism. Considerations of these factors plus the realization that any accidental ejection of the seat through the canopy would represent not only an heroic but also terminal event to the occupant, should be kept well in mind as further modifications are debated. It would also appear pertinent to cycle the initiating mechanism through several hundred activations to determine its incidence of malfunction, which could be so low as to eliminate the whole argument.

3. Survival kits and seat packs.

a. The policy was enunciated that kits should provide for optimal chance for survival rather than on escape and evasion. With this in mind plus the possible acceptance of a standard 'year around' survival pack, the operational people will confer on this problem further and submit their final recommendations for the pack contents.

b. As an item to be considered for future modification, both the size, shape and contour of the seat pack was discussed. Recommendations for further work to be done on these packs will be submitted to OSA as a part of an over-all modification program to be initiated at an early date on all the personal and protective equipment as currently exists.

c. On the point of the type radio to be used in survival packs, there were conflicting remarks and opinions expressed. Our group maintained that only the Sarah beacons were useful in the Alaskan theater and the other maintained that URC-11's had a much wider range of usage and furthermore that [redacted] had stated that Sarah radios could not be used on actual operational missions; though the basis for this statement was not known. This particular point needs early clarification.

4. Summation of equipment status and evaluation.

a. Both users and suppliers concurred in the adequacy of the existing equipment for operational use specifically in terms of pilot safety and effectiveness.

b. Minor modifications can and will be incorporated without invalidating past testing procedures which will improve the equipment particularly in terms of pilot comfort and function .

c. A development and test program leading to over-all modifications and improvement on the equipment will be formulated and submitted to OSA in the near future. This program will be neither extensive nor expensive and will cover a time period of approximately 6-8 months. At this time in the test period of the over-all system, no major change in the personal and protective equipment is indicated.

STATINTL

Next 2 Page(s) In Document Exempt

Approved For Release 2004/01/16 : CIA-RDP75B00285R000400040001-3

May 1, 1963

STATINTL

To : [redacted]

Subject : Anti-Reflective Coatings for Helmet Face Plates

STATINTL

The problem of reflections occurring on the inside of our face plates is still extremely serious. Over the past six months we jointly have not made any progress towards alleviating this situation. I haven't heard of any new devices, reflective coatings, or materials appearing at [redacted] for pilot evaluations.

STATINTL

COPY

In particular I am concerned about the fact that we directed Joe to CONTACT [redacted] for reflective coatings but he was told by [redacted] that they couldn't do anything for him. In the meantime, I have obtained two samples of reflective coatings on plastics which have been deposited by the [redacted] These two coatings are as follows:

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1. This coating has the best anti-reflective characteristics but is the least durable. It is known at [redacted] as [redacted] 157C-50.

STATINTL

2. A second coating has good anti-reflective characteristics and in addition is the most durable. It is known as [redacted]0.

STATINTL

I would like to have two face plates immediately coated, one with each of these [redacted] coatings so that we can try them out here. The deposition samples I saw were made on flat plastic samples and it could be that [redacted] would have a difficult time coating a curved surface such as our face plate. If this is going to require some development for deposition tooling of some sort, I still believe we should go ahead and do it since there is no progress being made on this problem at this time.

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Please advise me as to when the coated face plates should be available [redacted]

STATINTL

Best regards,

[redacted]

STATINTL

kld
cc: [redacted]

STATINTL

JAR-602-145

[redacted]

 TO: [redacted]

SUBJECT: Anti-Reflective Coatings for Helmet Face Plates

 REFERENCE: [redacted] letter 1 May 1963

Dear Ed:

The lack of solution for the reflectance problem does make it seem as though there has been nothing done to date, but we should list the efforts we have attempted so that they will not unnecessarily be repeated.

1. Our contact with [redacted] at [redacted] was pursued up to the point of furnishing them a visor on 27 December 1962 for coating by their currently standard processes which you name as [redacted] 157C-50 and [redacted] 50.

Upon examination of the visor to be coated, [redacted] declined to work on the problem with the expression that they did not have the capability to coat compound curvatures and that it would require research to determine whether or not it could be done. Additional research would be required to determine the effect of overcoating the conductive coating film.

Further, the schedule in the Research Section was such that this problem could not be undertaken at this time.

[redacted] seemed to have placed the responsibility for pursuing my request in the hands of [redacted] who declined to further pursue the problem.

It is conceivable that this problem may be reopened with [redacted] but we believe it would have to be pressured with development funds and project clearance. We will pursue it on that basis if authorized to do so.

5. Several other approaches, including the study of closely positioned internal reflective shields, are being pursued quite diligently here.

This particular approach would permit external adjustment and, if successful, would possibly eliminate the external sunshade which is an additional source of reflectance when used under adverse conditions.

6. Additional commercial anti-reflectance coatings made by "Sun-X Glass Tinting" (duPont trade name) were applied at our company's facilities with the advice of local representatives and recommendations of the manufacturer but the results were not acceptable, primarily due to optical distortion.

Our observations, as we continue to try to find an answer to the reflectance problems, tend to point up several seemingly irreversible conditions.

a. To reduce reflectance of a visor located at the distance from the face as in the present helmet, we must eliminate or reduce the light reflectance capability of the background which causes the image on the visor, namely, the shining face. Conditions are worst when sweat is on the face.

b. Anti-reflectance coatings cause a definite reduction in light transmittance which reduces the visibility of objects outside the visor during <u>all</u> periods when the visor is closed, in effect, a continuous sunshade.

We can imagine some conditions, such as night flight, certain positions and times of day on rendezvous, night landings, etc., when maximum light transmission obtainable would be the objective. We already have a penalty in this area with the conductive coating for heating the visor and additional reduction may be critical.

c. Best possible solutions will come from a mask and close-fitting visor with a minimum reflecting surface.

The close-fitting visor would necessarily call for an entirely new approach on the helmet.

Ed, these are the activities which we have undertaken to date and all the irons are still in the fire except [redacted] because they declined to continue. STATINTL

We will continue this approach until we get further guidance on the possibility of getting some of these sources cleared for the project so that they might be "pressured" more than we can now do. If we are authorized to make some bolder commitments of development funds, which will be necessary to put "pressure" on some of these people, perhaps a solution to this problem may be found sooner than at the present pace.

Please be assured of our continuing interest in all problem areas. We are sure we are doing our utmost, under the circumstances. If there is any further suggestion that you may have, please call.

Cordially, STATINTL

[redacted]

STATINTL

cc: [redacted]

STATINTL

STATINTL To : [redacted]

Date : May 3, 1963

STATINTL From : [redacted]

Subject : Seat Ejection and Parachute Tests

The slow speed ground ejection test program was completed on April 9, 1963; we are now ready to go into the F106 test program.

The ejection seat test program in the F106 will start the week of May 8, 1963 when we arrive at El Centro to modify the F106 for these tests. We plan to furnish the following hardware and help:

1. Ejection seats including all expendable ballistics.

2. Seat installation hardware in the F106 for at least four ejections. There will be no speed sensors used in these tests. Delays in seat separation will be predetermined and set.

3. Personnel to install seat in the F106 in cooperation with Air Force help at El Centro. This will require three mechanics from here, two structural and one armament for approximately four days.

4. An armament mechanic for the duration of the program, approximately six weeks.

5. Two engineers for the duration of the program for parachute, ejection seat preparation, and current analysis of the test results.

6. An instrumentation engineer for the first ground firing and for help only as required thereafter, one week's work.

In addition to providing the main flight test and scheduling for this test program, we are planning on the Air Force, El Centro, and Edwards facilities to furnish:

1. The instrumented dummies and their associated telementry.

2. All ground, ground to air, and air to air camera coverage, including documentary films and stills as requested.

3. The nets required for seat recovery from the ground firing.

We are planning on the Firewel Company to provide the following:

1. All test parachutes required complete with emergency oxygen.

2. Survival kits required in addition to that supplied for the telemetry package.

3. Pressure suits and other dummy apparel as required.

4. Seat, vent, and other disconnects for simulation of a complete production system for these tests.

As a result of the coordination meeting with Edwards and El Centro AFB personnel, the following schedule was determined for these F106 seat ejection tests:

<u>Test #1 - May 16, 1963</u>

A static ejection seat test will be conducted on the ground at El Centro. This test is primarily to be certain that no safety factor has been overlooked prior to conducting the inflight ejection seat tests. The recovery net at El Centro will be positioned relative to the F106 so that the seat and dummy will be recovered undamaged. The personnel parachute will be fully operational and an attempt will be made to recover the dummy with this parachute during the test. In addition to this, the seat recovery parachute which is actuated by a drogue gun will also be used.

This seat will be fired by remote control in the same manner as used on our sled tests.

Sufficient camera coverage will be furnished by Edwards AFB to verify the trajectory of the seat during this firing. This camera coverage can be a minimum since the seat trajectory is known from previous static tests. The predicted trajectory for this static test is shown on Figure 1, and should be used in positioning the F106 relative to the recovery net. This trajectory assumes that there is no operation of the seat recovery parachute.

<u>Test #2 - June 4, 1963</u>

The first flight test with the F106 will be conducted at mach .9 and 20,000 feet. This test is to confirm the low altitude capability of the parachute system and the timers. The four second delay for seat separation will be used as installed on production systems. The seat trajectory expected on this test is shown on Figure 2.

The air to air camera coverage on this test will be provided by three T38 aircraft from Edwards AFB. A tentative location for these airplanes at the time of seat ejection is shown on Figure 3. The primary information required from this camera coverage is that of seat ejection and the first six seconds thereafter. Further camera coverage after this time is desirable and might be useful, but is not important to the successful completion of the test.

Ground to air coverage for this test will be provided by the "Big Eye" camera at El Centro. The primary use for this coverage is to ascertain dummy movements after the drogue and main parachute operations.

The instrumentation to be used on this test will be primarily installed in the dummy. Information on the drogue riser loads, the main riser loads, the dummy rotation both before and after seat separation and the dummy accelerations are desired. The instrumentation telemetering package will be packaged in a survival kit. The survival kit harness is to be modified so that there is absolutely no possibility of it separating from the dummy during any portion of this test.

Test #3 - June 11, 1963

This flight test will be conducted at Mach 1.55 and 50,000 feet. A seat to dummy separation time will be used on this test of one second. The purpose of this test is to have the seat separation and drogue operation occur under conditions which impose the highest air load ever expected upon ejection. The seat trajectory predicted for this test is shown on Figure 4.

The air to air camera coverage for this test will be provided by three F104D aircraft from Edwards AFB. As above, the critical camera coverage will be for the first six seconds during and after seat ejection. A tentative position for the three F104D aircraft relative to the F106 at the time of seat ejection is shown in Figure 5.

Ground to air coverage again will be with the "Big Eye" at El Centro. The requirements for camera coverage and instrumentation are the same as in Test #2 above.

Test #4 - June 18, 1963

This test will be conducted at Mach 1.82 and 46,000 feet altitude.

This will be a complete production seat and parachute system and will use the four second seat to dummy separation delay. A complete pressure suit and helmet will be used on the dummy during this test. The predicted trajectory for this test is shown on Figure 6.

The air to air camera coverage for this test again will be provided by three F104D aircraft from Edwards AFB. The tentative positioning of these aircraft during the test is the same as shown on Figure 5.

The camera coverage and instrumentation required are identical to those requirements for test #3 with the exception that additional instrumentation should be provided to monitor the operation of the pressure suit during ejection and let down on the parachutes.

Test #5 - June 25, 1963

This final test may or may not be conducted depending upon the results of the first three flight ejection tests. This test is intended to provide a maximum drop distance for the dummy on the drogue parachute. If the June 11, 1963 test conducted at 50,000 feet indicates that no problem exists with regard to dummy rotation during the descent on the drogue parachute, this test would be waived. If this test is conducted, it will be under the following conditions.

This seat ejection test will occur at whatever mach number is consistent with the maximum altitude that the F106 test aircraft can attain The seat and parachute system will be identical to that used in Test #4, and again the pressure suit will be used.

The air to air camera coverage for this test will probably be a minimum because of the difficulty of rendezvousing at high altitude for this purpose. One F106 school aircraft from Edwards AFB is to be used for camera coverage.

Since neither air to air or ground to air camera coverage will suffice for determining the dummy rotation during descent at high altitude, it is important on this test that the instrumentation for telemetering dummy rotation be used.

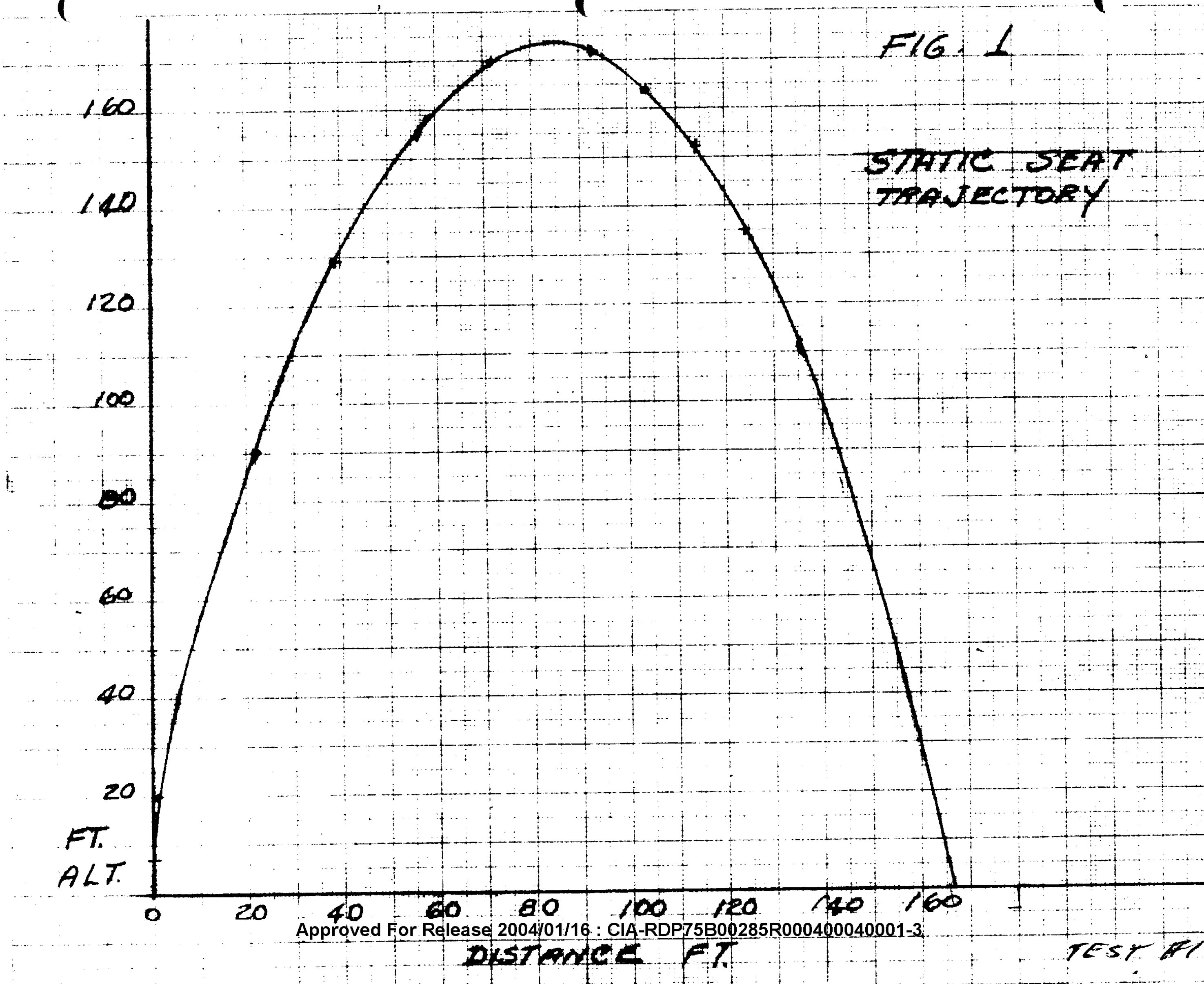
The above concludes the test schedule for the F106 tests. An overall plot of these tests is shown in Figure 9. It is realized that the use of three F104D aircraft for camera coverage may not always be possible.

Two F104D aircraft for camera coverage are considered sufficient for these tests and the positions that these would take in the event are shown in the Figure referred to above.

In order to properly schedule their activities, Edwards AFB must be advised of our firm current flight test schedules every Wednesday afternoon starting on May 29.

We will arrive at El Centro AFB on Wednesday morning, May 8, 1963, to start modifying the F106 rear cockpit for these tests. [redacted] will be the engineer at El Centro in charge of our work on this program. He is assisted by [redacted] for parachute and oxygen system maintenance.

kld



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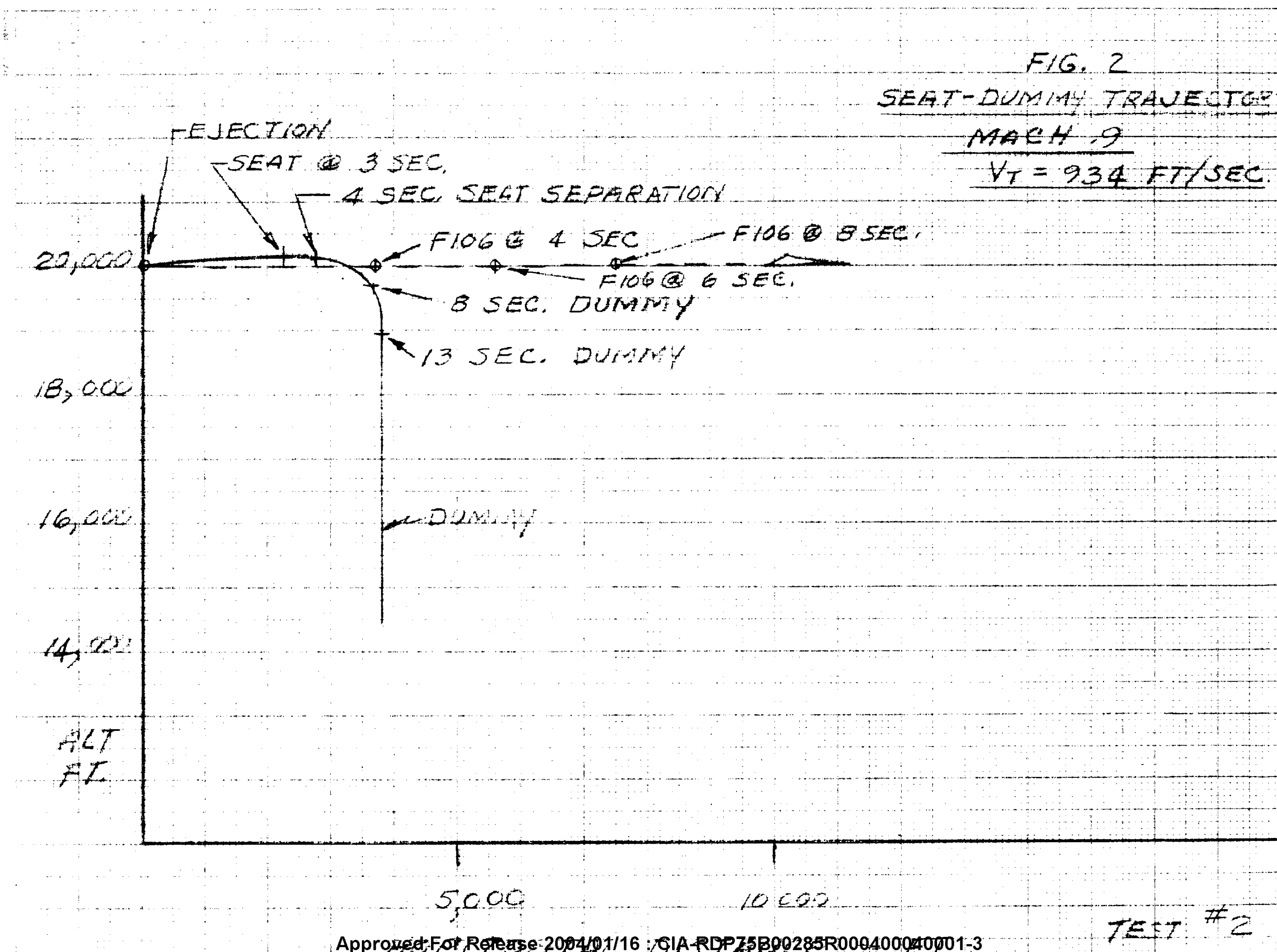

FIG. 2
SEAT-DUMMY TRAJECTORY
MACH .9
V_T = 934 FT/SEC.

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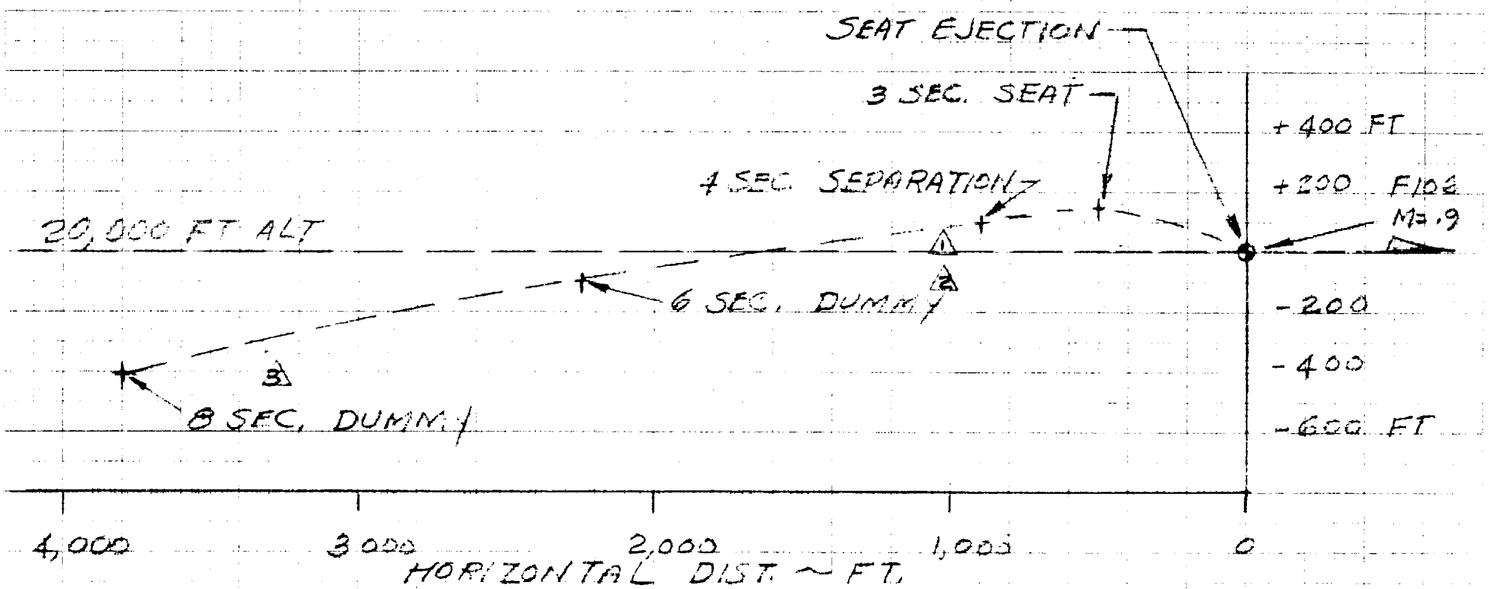
D.Z.
4-4-63

FIG. 3
PROPOSED CAMERA POSITIONS



- F106 WITH SEAT @ M=.9 @ 20,000 FT ALT HDG WEST
- 1 1ST PHOTO PLANE @ M=.9 SAFE DIST PORT SIDE
- 2 2ND PHOTO PLANE @ M=.9 SAFE DIST STARBOARD SIDE
- 3 3RD PHOTO PLANE @ M=.9 SAFE DIST PORT SIDE

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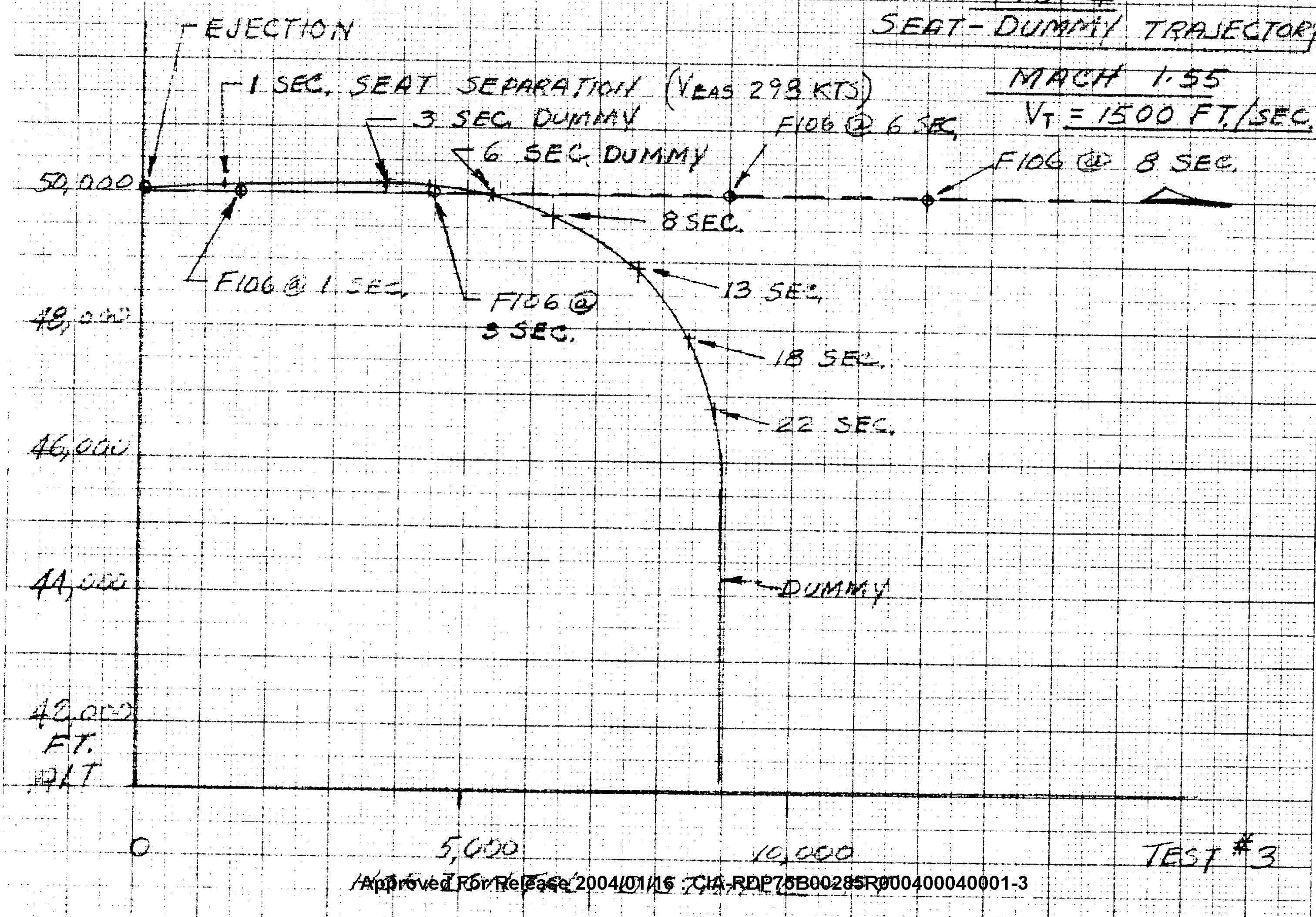
TEST # 2

PREPARED BY D.Z.
DATE 4-4-63
CHECKED BY

FIG. 4
SEAT-DUMMY TRAJECTORY
MACH 1.55
V_T = 1500 FT/SEC.



TEST #3

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MODEL
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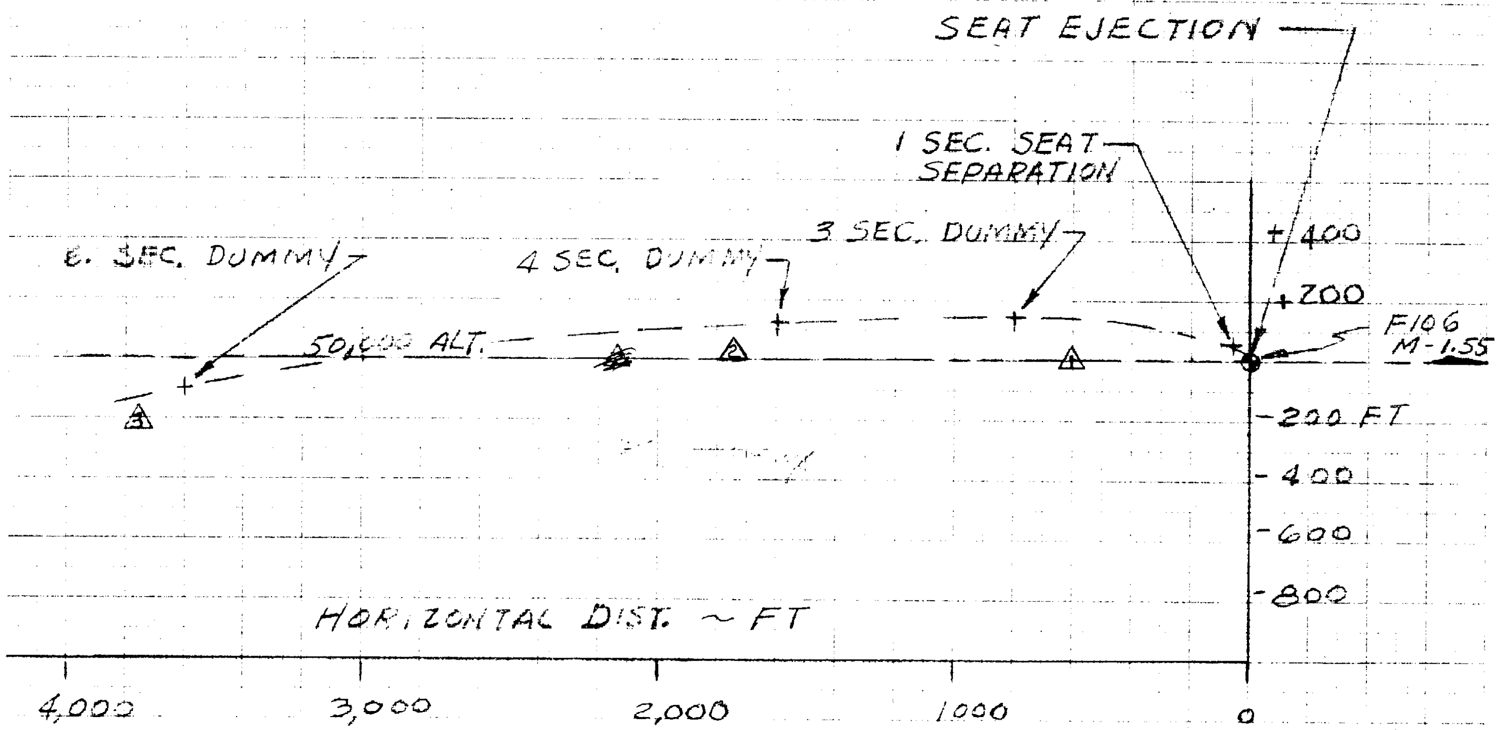
FIG. 5

PROPOSED CAMERA POSITIONS

PREPARED BY D.Z.
DATE 4-4-63



⊕ F106 WITH SEAT @ M=1.55 @ 50,000 FT. ALT HDG WEST

△1 1ST PHOTO PLANE @ M=1.55 A SAFE DIST ON PORT SIDE

△2 2ND PHOTO PLANE @ M=1.55 A SAFE DIST ON PORT SIDE

△3 3RD PHOTO PLANE @ ... A SAFE DIST ON STARBOARD

TEST # 3.

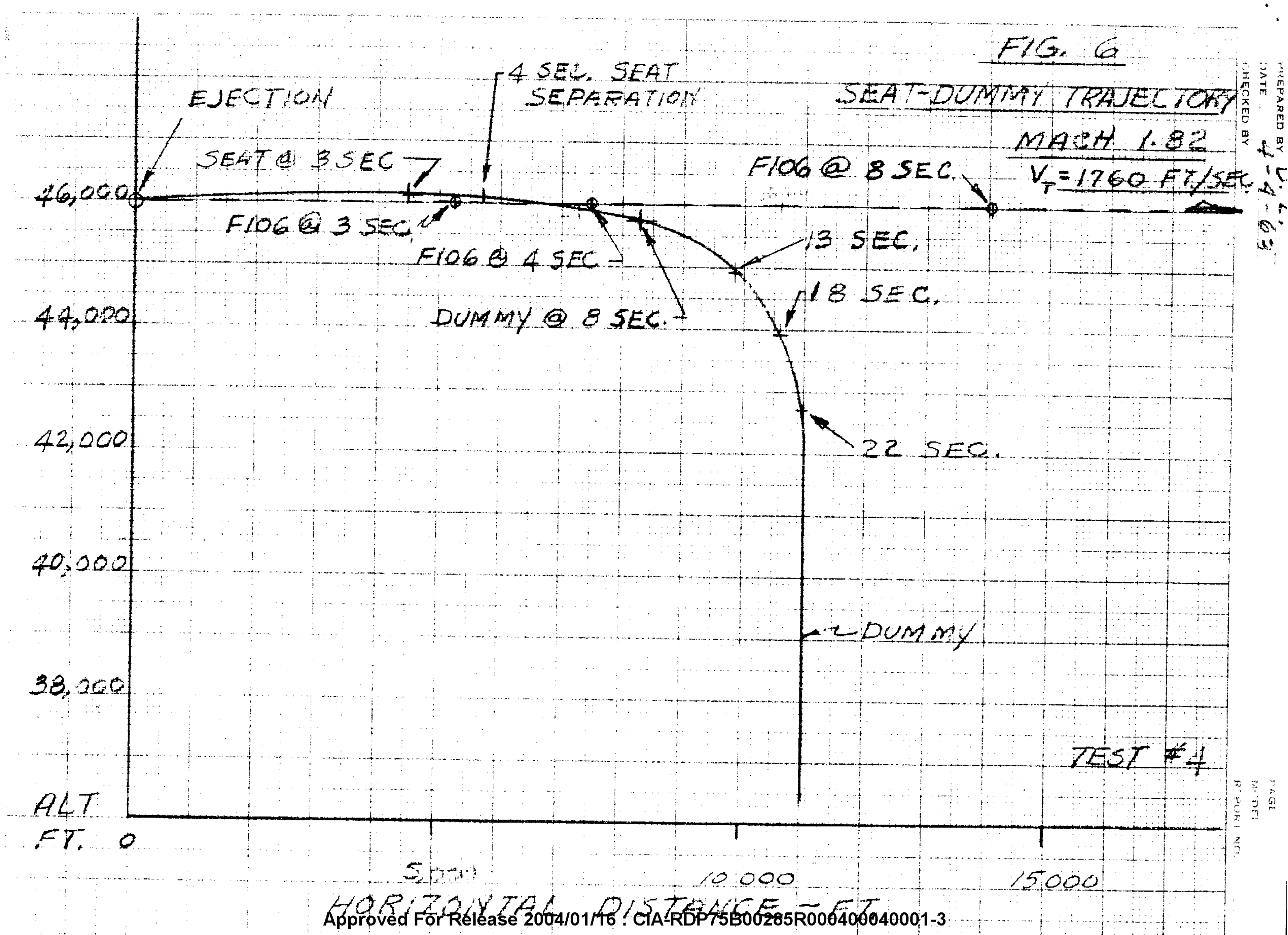


FIG. 6
SEAT-DUMMY TRAJECTORY
MACH 1.82
V_T = 1760 FT/SEC.
EJECTION
SEAT @ 3 SEC
4 SEC. SEAT SEPARATION
F106 @ 3 SEC.
F106 @ 4 SEC
F106 @ 8 SEC.
DUMMY @ 8 SEC.
13 SEC.
18 SEC.
22 SEC.
DUMMY
TEST #4
46,000
44,000
42,000
40,000
38,000
ALT FT. 0
5000
10 000
15000
HORIZONTAL DISTANCE ~ FT.
PREPARED BY D. L.
DATE 4-4-63
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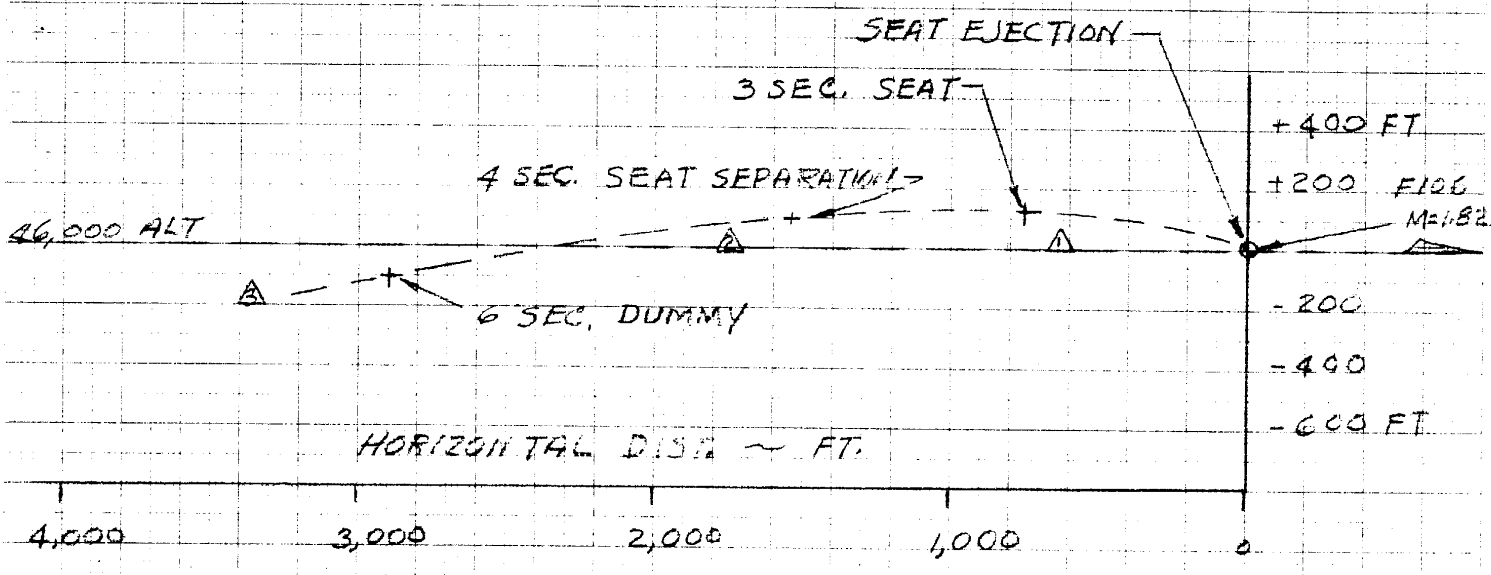
D. Z.
4-4-63

FIG. 7
PROPOSED CAMERA POSITIONS



- ⊕ F106 WITH SEAT - DUMMY @ M = 1.82 @ 46,000 FT. ALT. HDG WEST
- △ 1 ST PHOTO PLANE @ M = 1.82 SAFE DIST. PORT SIDE
- △ 2 ND PHOTO PLANE @ M = 1.82 SAFE DIST. PORT SIDE
- △ 3 RD PHOTO PLANE @ M = 1.82 SAFE DIST. STARBOARD SIDE

TEST # 4

PREPARED BY D. C.
DATE 4-1-63
CHECKED BY

DESCENT TIME IN SEC
ONE G ON DROGUE

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REPORT NO

PREPARED BY L. C.
DATE 4-1-63
CHECKED BY

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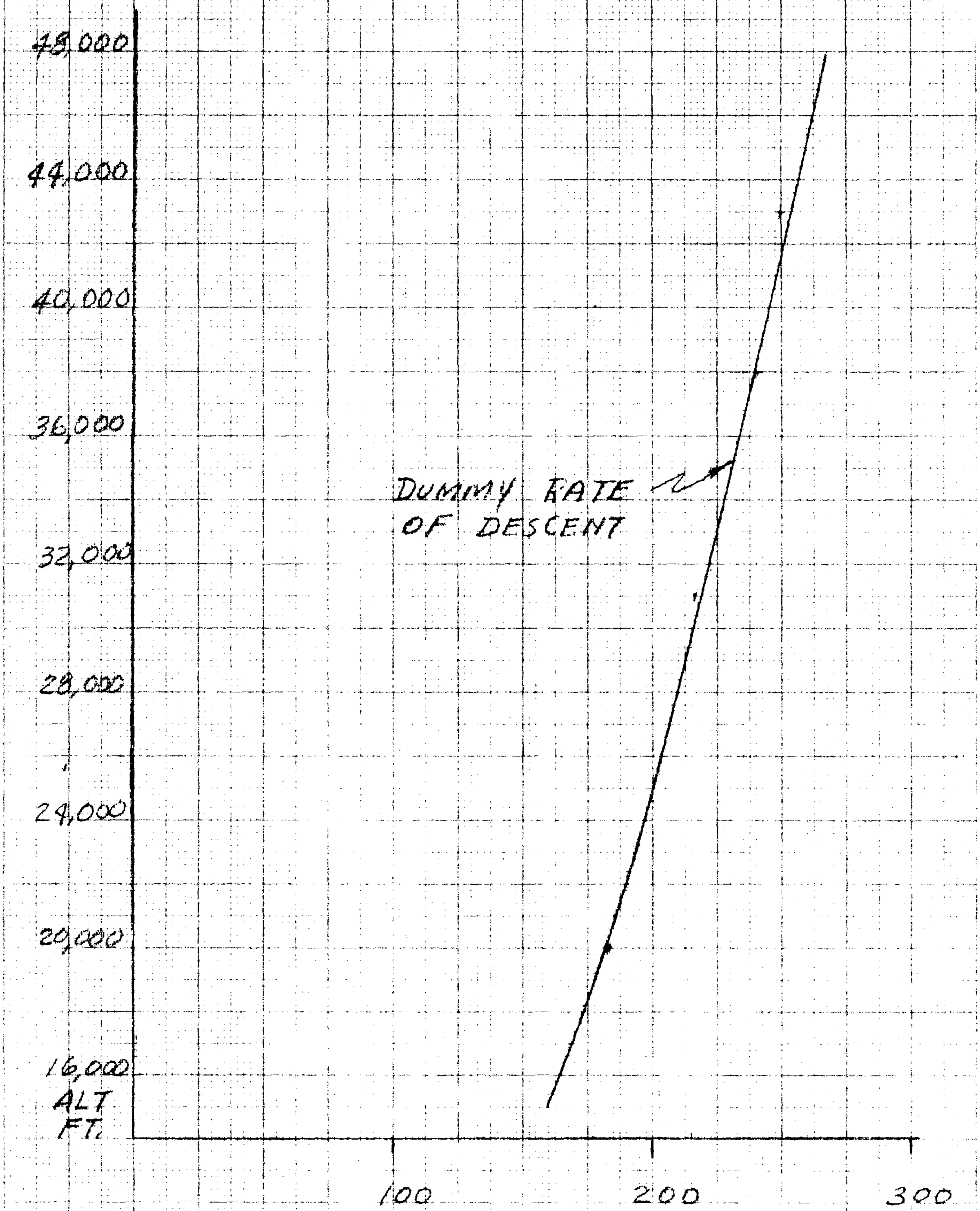


1 G ~ DROGUE RATE OF DESCENT FT/SEC.

FORM 5229

July 25, 1963

To: Office of Special Activites
[redacted]

Subject: Status report on Equipment Development and Test Program

A meeting was held with headquarters personnel from both development and operational sections at which time Harry [redacted] and I presented current data on the equipment program. Specific items discussed were:

1. Escape ejection configuration which has successfully met all stress tests to which it has thus far been exposed. Opening forces, starilization, deceleration gradients and integrity against blast all appear well-controlled to safe human tolerance levels. Aircraft ejection tests will continue to include maximum Q on total assembly and maximum opening forces directly on the main parachute.

Conclusions: Escape Ejection Configuration meets operational requirements and production item will meet operational readiness date.

Further Recommendations :

927

(a) Submit to Development section a proposal for completing both a dummy and live ejection from the back seat of the 2 place vehicle flying under maximum external stress force conditions of the mission. 1.55

(b) Discuss with Chief of Develpment procedures by which test data can be made available to other potential users in NASA and DOD.

(c) Investigate procedures currently being followed to insure that AF specifications and quality control standards are being met by all components.

2. Full pressure suit and ancillary fittings. Results of my informal discussion of the rig with the white trianees

indicate that their major areas of concern at present are; lack of ability to stretch out legs in the cockpit; discomfort from and difficulty in turning the head and the pressure helmet together. Associated with the latter problem are such other items as discomfort from ear doughnuts if ears are dislodged during press-to-test procedure; excessive oxygen leakage and or consumption; discomfort from the suspension system in the apex of helmet with imposition of excessive weight on head and neck when head is inclined downward. The currently held opinion by the trainees is that most all of the problems enumerated herein regarding the helmet, visibility, oxygen consumption could be most satisfactorily resolved by changing the configuration from a face seal as presently designed to a neck seal. One such configuration has been lashed up and tried out by one non-trainee subject who has had experience using the existing face seal configuration. The results of this one test indicated no significant difference in O_2 consumption and a stated subjective comfort preference for the face seal configuration. Present plans are to modify a second article being fabricated for one of the trainees into a neck seal garment and conduct further in flight tests for both comfort and oxygen utilization.

Conclusions: The pressure suit configuration as it stands now does meet operational requirements and would profice both routine and emergency protection as required. Current results of oxygen consumption measured somewhat crudely indicate that with the larger oxygen bottles and higher pressures we can meet the mission requirements even having to accept the exciting 20.0 ± 2.0 liters/minute oxygen utilization rates. Continued attempts should be made to make such improvements in the rig as can be done readily and inexpensively without altering the basic configuration. Further attempts to more accurately define and quantitate the factors involved in the oxygen utilization problem should be carried out before any decision is made to convert to a neck seal configuration because of so-called confort preferences being now expressed by both white trainees and company drivers. <u>NOTE</u> All data from past experience accumulated at the Aeromedical Laboratory in testing similar rigs in both experimental and operational aircraft indicates fairly close agreement with the current utilization rates being recorded during training flights inthe operational vehicle; i.e. 18-24 liters oxygen/minute.

Further recommendations:

(a) Develope more accurate means of measuring oxygen utilization during both ground simulation and training flights.

(b) As a part of (a) review very carefully the relative merits of both the spring loaded and compensated exhalation valves.

(c) Maintain the basic rig design (face seal) as standard for operational use until more definitive studies can be accomplished on the neck-seal modification. Questions concerning the adequacy of ventilation to the head arise when one considers the neck-seal modification. In addition, though not a technically difficult problem, there is the requirement for relocation of the inlet hoses into the helmet when one goes to the neck seal configuration. [redacted] and I advise against modifying more than one additional rig into the neck seal configuration until further testing can be done.

(d) Although the reflectance problem was not raised, it is recommended that the Clark company continue to explore various likely possibilies toward a satisfactory resolution of this potentially distracting factor during the mission.

(e) Investigate and report upon the contractor's current efforts in redesigning the rudder pedals into a flop-over configuration which would allow full extension of the feet for relief of back muscle and thigh fatigue.

(f) Determination of crew performance capability under mission simulated conditions. This topic will be made the subject of a separate more detailed report since there are many factors involved in such a study. Suffice to say, the criticality of the mission products are such as to demand conclusive proof that crew performance capabilities during all phases of the mission will not be degraded, by fatigue or other factors, below acceptable levels. The degree to which all stress factors, psychological and physiological, to which the trainees could be exposed during a maximum mission is not currently known but I believe that some useful studies can be made without undue expense which will give us more accurate data than we currently posses. My personal opinion is in the affirmative but I still recommend that we proceed with our investigations regarding mission simulation procedures which could be used and which could provide all concerned with reassurance on this very vital point.

4. Discussion of crew control procedures indicated that these procedures and facilities as they are currently being planned

or used by both the I's and the O's need careful review, re-valuation and reporting upon. This action will be carried out.

5. Questions regarding survival kits, gear and procedures were deferred to an early meeting with responsible people in attendance to cover this specific subject and submit final recommendations.

6. Presentation was made of the current status of the Beckman developed Hypexia warming system which is about to go into an operational test and evaluation phase at two Air Force installations. A recommendation was made to the Chief, Development section, that we procure 3 such articles costing approximately [redacted] for integration and test in our own equipment. This suggestion was accepted, required funds authorized and implemented action will be taken.

7. Conferences were held following this meeting at Worcester, Massachusetts and by phone with oxygen system suppliers. General concurrence on major points was received but final ironing out of details will take place at the field station on 31 July, 1963, during a meeting being called by the station commander to discuss in detail the items included in this report.

[redacted]

Brig. General, USAF, Ret.

mis

JAR-602-165

[redacted]
Parcel Post Station
Worcester, Mass.

TO: [redacted]

SUBJECT: Discussion Items
31 July 1963 Meeting

The following items have been subjects for discussion and requests for corrective action since the last program review:

1. Suit altimeters:

We have preapred an ECP for a retrofit kit, Proposal No. CDC-ECP-6 dated 12 December 1962.

Two units have been fabricated and sent through channels to [redacted] for installation and evaluation.

Further action is dependent on instructions to proceed.

2. Wedge-soled shoes and "spurs" for locking feet during ejection:

This subject has not been fully clarified. Some variation in personal preference exists in wearing spurs permanently attached to the heels versus the strap-on standard type.

Easily removable "spurs" have been requested and several design approaches have been studied and will be presented for review at the forthcoming meeting.

The design of the "spurs" has been complicated by the fact that no solid decision has been made as to whether or not wedge-soled shoes will be used.

It is hoped this will be resolved at the forthcoming meeting.

3. Watch pocket:

un satisf.

The request for an integrated pocket on the right arm of the suit to accommodate an Accutron watch was fulfilled. A recent request was made for a pocket redesign, due to the adoption of an Astronaut's Accutron watch with a movable external dial.

This request is being processed at the present time.

4. Helmet weight distribution:

STATINTL

A balance spring was designed and evaluated with [redacted] as a subject.

His personal feeling was that the spring should be heavier.

Several gauges of standard spring material were tried; ultimately, a special sized wire was ordered and the spring is in the process of fabrication. It is anticipated it will be available for the 31st of July.

5. Pockets for outer garment:

STATINTL

A request from [redacted] called for removing the pocket flaps and installing white zippers in lieu of black.

STATINTL

STATINTL

Several coveralls were modified but a reversal of this request by [redacted] was made through [redacted]

At the present time, flaps are being included on the outer garments.

6. Hold-down assembly:

Several attempts to improve assembly performance have been tried:

a. A longer locking bar tab has been made and sent to [redacted] for evaluation.

STATINTL

b. Treatment of one side of nylon tape with Teflon to reduce friction resulted in failure due to degradation of nylon during high temperature cure.

d. Commercial coatings designed to reduce reflectance on glass surfaces have been investigated, including those available from [redacted]

Coating of plastic visors with compound curves was indicated to be a problem which would require research funds, according to [redacted]

My letter request to [redacted] for authorization to pursue this has not been acknowledged.

8. <u>Oxygen consumption:</u>

Several elementary comparison tests, including subjective and mechanical, have failed to show a wide difference in oxygen consumption between the MA-2 and S901E helmets.

Considerable speculation exists throughout all quarters as to why present oxygen consumption rates during flight are higher than estimated. Since there are basic differences between the MA-2 helmet and the S901E helmet, principally the neck seal in the MA-2 and the face seal in the S901E, it has finally been directed that some S901E suits be converted to a neck seal configuration.

The first such suit was the suit for [redacted] Ground level tests and simulated altitude tests failed to show significant differences in consumption rates under these carefully controlled conditions.

The second suit to be modified was the suit for subject 1045. It is anticipated that he will be able to evaluate the suit in flight and give direct comparisons between the two configurations.

Additional suits scheduled for conversion are one each for [redacted]

It seems that some preliminary evaluation should be accomplished with one, or possibly two, prototypes before proceeding with the total of five.

There are certain debatable advantages as well as disadvantages to each approach and some that should be considered in any evaluation are listed below:

Neck seal

Advantages -

a. Potentially more uniform seal around the generally cylindrical neck.

b. Potentially less disruption of the seal during gross and strenuous movement of the head against the helmet harness.

c. Potentially looser, more comfortable fit of the helmet under pressurized or unpressurized conditions.

Disadvantages -

a. Larger dead space volume with potentially higher CO_2 concentrations.

b. Head ventilation limited to rate and condition of breathing oxygen being used.

c. With the present helmet oxygen plumbing system, a complexity of hoses and disconnects is prevalent. This perhaps would not necessarily have to prevail if complete oxygen system redesign were authorized.

Face seal

Advantages -

a. Smallest dead space with potentially lowest CO_2 concentrations.

b. Best head ventilation possible due to rear portion of the helmet being exposed to the ventilation circuit.

c. Maximum sensitivity of the breathing regulator to deliver oxygen on demand due to small face cavity volume.

Disadvantages -a. Face seal must remain in contact with the face continually with some degree of pressure to ensure positive seal. Degree of pressure is variable dependent upon facial contours and smoothness.

b. Gross and strenuous movements of the head may cause temporary seal leakage thereby increasing oxygen consumption.

c. Comfort is potentially a problem if seal must be worn with constant pressure to effect a positive seal.

d. Helmet fit is potentially more critical during the transition between unpressurized and the pressurized condition.

9. Suit fitting philosophy:

Recent discussion with Bill P. on his experiences with the vehicle pressurization system behavior during emergencies suggests that the basic approach to suit fitting might be able to be revised.

Bill's comments suggest that long-term suit pressurization is not apt to be experienced due to factors he proposes to present in conference. The effect of Bill's proposal might be that a suit could be fit looser for more comfort for long-term wear.

10. Turtle-neck underwear:

Some complaints of chafing by the oxygen hoses at the neck were registered and underwear with a turtle neck was developed.

Evaluation results indicated acceptance of the new underwear.

A previously experienced problem of shrinkage became evident and upgrading of sizes and preshrinking before issue was instituted as a procedure.

11. O.D. colored underwear:

For purposes of E&E, underwear was requested to be dyed O.D.

Since this is a special order for special underwear, delivery was not immediately available.

12. Sundry - and not always unanimous opinioned - comments on the following subjects have been reported:

a. Head padding discomforts.

b. Ear cushion discomforts.

c. Pocket relocation, addition, deletion.

d. Stick grip and glove incompatibility.

e. Glove ventilation inadequacy.

Should there by any question on these subjects - or more detail required - please call.

Cordially,

STATINTL

:mm

OUTER GARMET: Ventilator on

31 July 63

2. Packet-pocket. - inside

SHOES:

1. Wedge soles. - Flat soles - ? Spurs are standard.

2. Q.D. for spurs - 3 approaches - 3 methods?

PARACHUTE:

1. Protrusions from emergency oxygen cover. Screws on back & latch corner.

2. Excess loss of emergency oxygen pressure. 1800 bleed down - 24 hours. Pull force 25 lbs?

3. Keeper for oxygen lines. flailing on bail-out.

4. Emergency oxygen QD. -

SEAT KIT:

1. Comfort. ✓ Sleeping bag - cushion - 75% basic area used for butt pressure. Thickness of parach. pack.

2. Sleeping bag cushion.

3. Parachute straps under seat cushion. - Some complaints.

MISCELLANEOUS:

1. Urination. -

2. Water intake. - water intake -

3. Suit and Helmet pressure check at A/C. eliminate.

* ✓ 4. In-flight recorder.

AIRCRAFT:

✓ 1. Improved oxygen gague.

2. Face heat control.

3. Reschedule cockpit pressurization.

→ 4. Provide over-ride control of seat separation timing in event of air data computor failure. Board

5. Relocation oxygen hose QD's from front of seat away from ejection "D" ring.

6. Change O_2 pressure warning light to indicate low breathing pressure or possibly both low and high oxygen pressures.

0900, 31 JULY - Commanders Conference Room

 Miniature

SUIT: Small gains - no major Counter receivers

Suit's neck seal has spring.

HELMET:

1. Helmet weight. - Webbing configuration of suspension pads.

duality phylosophy

2. O_2 disconnect in helmet area. - single hose? 4 disconnects dual hose - face seal.

3. New microphone. - pencil-type (Hg) $700.00

4. Visor reflection. - 2nd major problem. - both flat + curved. LOF

Face mask + eliminate

5. Hypoxia Warning Device.

6. Face heat contacts. - doesn't always make contact - Joe -

7. Antisuffocation valve. - 30 sec's.

8. Exhalation valve. - Compensation valve? Spring loaded.

GLOVES:

1. Removal/replacement of restrain bar. - Mae - fly s restraint bar steel pull D ring.

2. Modify surface of glove. ② Slick - Strips - individual.

3. Watch pockets. - Snaps.

SUIT PROPER:

1. "Keeper" for oxygen hoses. - standard - all suits.

2. Suit altimeter. requirement 2/driver

3. Loops on zipper. - on neck.

4. Green underwear. - coming E + E

STATINTL

5. Improved "tie-down" cable. retrofit - HT-1 c Teflon - longer lever on locking bar

6. Single oxygen hoses with disconnect in helmet area.

7. Manual "press-to-test".

29 August 1963

Subject: Brief Report on Project Aeromedical Support Conferences and Activities to IECS to Col. Jack Ledford

1. A conference with [redacted] at the Lovelace Foundation and subsequently with [redacted] and selected members of his staff at the Lovelace Foundation, Albuquerque, New Mexico, has resolved all questions regarding the type of continuing medical evaluations which are to be given project operational personnel by the Lovelace Foundation. Scheduling of personnel to the Foundation can begin immediately; and as I understand it, it will be accomplished in the following manner: Upon submission to OSA of a request for specific personnel to undergo the five-day medical evaluation at the Lovelace Foundation from [redacted], then either myself or authorized project personnel will transmit the information to [redacted] who in turn will contact [redacted] to obtain the necessary concurrence from the Foundation. [redacted] from OSA who participated in the conference with the Lovelace Foundation people has tentatively approved the method of handling these project personnel at the Foundation.

2. [redacted], as previously planned, will spend one day a week (Friday) holding a family general practice clinic for project personnel dependents in the area at the regional Air Force hospital. All concerned are very favorably inclined toward the initiation of this professional service of the families and I personally support the project wholeheartedly. At the same time, I would be remiss if I did not point out that even at the present level of population at the area and despite 16-hour days being put in by all project medical personnel, by combined professional medical and aeromedical total requirements to the combined project personnel are not being completely and satisfactorily met. The recent canceling out at the last minute of the two medical corpsmen for whom [redacted] had been waiting some six months has materially aggravated this particular problem, and it is of considerable urgency that those of us responsible at top level meet and resolve this particular problem with the least delay.

3. A conference between [redacted] and other ansillary personnel from the prime contractor met and reviewed the final configuration of the operational aeromedical protective equipment and also the specific items to be included in the model

improvement program which will be submitted to the Chief of Development, OSA, within the next ten days. It is, therefore, recommended that a meeting and conference date be tentatively assigned for the purpose of discussing in detail the various elements of this model improvement program with pertinent personnel in operations and development divisions.

STATINTL

Life Sciences Consultant

clw

Approved For Release 2004/01/16 : CIA-RDP75B00285R000400040001-3

17 September 1963

Subject: Operational tests and evaluation of personal protective equipment as pertains to crew-mission performance capability.

To: IECS, Chief of Operations Division

1. Considerable discussions have been held in the past, and several reports have been written covering the general topic of mission simulation under as realistic conditions as possible to firmly validate the capability of the air crews to perform the mission as prescribed with equipment worn under both routine and emergency conditions. This report is intended to summarize and bring up to date the actions which have been taken to accomplish this specific objective.

2. It has been pointed out in previous publications that considerable experience has been accumulated both experimentally and actual operations that with disciplined crews control procedures the average individual can be expected to perform effectively in a single-seated aircraft through 1 to 3 refuelings with adequate attainment of target objectives through a total period of 18 hours. In flight experimental work has show that with immobile crews (3 to 4 crew members) using a 4-hour duty and a 4-hour rest cycle that the desired level of crew mission effectiveness can beemaintained over a period of 48 to 56 hours. It should be pointed out, however, in citing these results that in none of these previous experiments either on the ground or in the air have the crews worn the same configuration of protective equipment as that which the project crewmen will be required to wear. Furthermore, it should be pointed out that the immobilization of the crews anatomy which is required in our current configuration is considerably greater than any imposed during these past experiments. Finally, and again a significant factor of considerable importance is that which at present doesn't provide easy intake of fluids and/or high caloric foods by our project air crews.

3. This important matter of determining prior to actual operational flights the capability of our project air crews to perform the mission effectively has been discussed in great detail and at considerable length with all project trainees. In my last memo

covering the most recent conference, it was pointed out that the consensus of opinion arrived at on this occasion was that the ground-mission simulation under as realistic terms as possible should certainly be accomplished on all trainees to obtain a much more realistic and varied answer to the basic question than is available at present from current training flight experience.

4   4. In my last conference held with the chiefs of both the operations and development division, it was agreed that we should proceed without delay in setting up a program by which this realistic crew performance evaluation could be ascertained. It was pointed out also at this conference that there were three possibilities related to a specific question of facilities locations where such a program could be carried out. These three possible locations were stated as being at Edwards Air Force Base in the Physiologic Unit; at the Aerospace Medical Research Laboratory at Wright Field; and finally at the contractor's physiologic training facility on the West Coast. During this interim period since this last conference, I have examined into this question of which of these facilities would prove most adequate and practicable for our use. The Aerospace Medical Research Laboratory at Wright Field, of course, offers a great many advantages, both from the standpoint of economy, availablity of technically trained personnel, and the preciseness which both the physiologic, psychologic and performance factors can be measured. The disadvantages in terms of travel required and security problems are fairly obvious. The The Physiologic Training Unit at Edwards Air Force Base under its present organizational structure (i.e., under the station surgeon and responsible for a routine physiologic training rather than its previous position in the R&D section) renders it fairly useless as a facility in which to carry out this test of OT&E program. Considerable discussions with the contractor's surgeon have convinced me that with all factors being duly considered the optimal facility to be used is the contractor's physiologic training facility.

5. The program herewith proposed to dissolve this importante crew mission question is as follows:

a. Each project trainee would undergo two chamber runs, one of six hours duration and one of 11 hours duration, during which time he would sit in a cockpit mock-up with complete protective gear and would perform a series of psychomotor tasks designed to simulate as closely as possible the mission requirements for operator performance.

b. The chamber would be programmed to simulate the outside and inside atmospheric pressures and during each one the trainees would be subjected to a simulated emergency condition in flight which would impose both a heat pulse and a loss of cabin pressure upon the subject.

c. The subjects would be instrumented in a non-restricted manner to provide continuous data on oxygen utilization, EKG, partial pressure of oxygen in the mask, skin temperatures, and respiratory patterns. On separate read-outs and synchronized in time constants there would be continuous records on the psychomotor performance of the candidates.

d. Biochemical studies would be carried out before and after each run to determine significant variations in homeostasis as resulting from a simulated in-flight stress.

e. All conversations between the test subjects and the test supervisors would be recorded on tape through the intercom system as would also be transcribed the post flight debriefing conducted by the test director and flight surgeon with each subject.

f. Subjects would be scheduled according to their availability in the training program, of course, on a non-interference basis.

g. The Chamber crew would be furnished by the contractor and the personal equipment, environmental control and oxygen systems technicians would be furnished by IECS using subcontractor personnel.

6. The problem of providing a competent aeromedical specialist to supervise this program has again been examined in detail and discussed with the contractor's chief surgeon, the results of which are cited in the following paragraph:

At the present time it is neither feasible nor practicable to utilize currently assigned aeromedical personnel in the project for this program in other than a part-time basis. Preliminary investigations on this question of availability of suitable Air Force personnel for use full-time on this proposed program have not proved fruitful.

The one possible solution which does appear feasible and attractive for the expeditious accomplishment of this program is one which provides a suitably trained individual through the prime contractor's resources working through AirForce personnel SAC surgeon and the contractor's chief medical officer it has been ascertained that a very confident, highly trained M. D.--flight surgeon--engineer is leaving, [redacted] He has completed a two-year assignment with SAC and is eager to continue on pursuing a career of experimental and operational aviation medicine in a civilian environment. Preliminary negotiations between the prime contractor's surgeon and [redacted] has resulted in an acceptance of a job offer working with the prime contractor; and the former has agreed to initially assign [redacted] to this program full-time as the medical officer in charge for a period of 3 to 4 months. Following the completion of the actual OT&E program, the contractor's chief medical officer further allow [redacted] to work part-time with the project trainees on any continuing or follow-up tests which might be needed.

7 7. If the above-mentioned program is approved at least in principle, then a number of actions need to be taken without appreciable delay. These are as follows:

a. Arrange through Air Force liaison to maintain the current top secret security clearance issued after full background information from First District, OSI, 27 September 1961, should not be closed out until final determination on acceptance of this plan can be consummated. In this connection, it should be also pointed out that a limited project clearance could be provided for [redacted] so that he could begin working on the program immediately after his resignation and release from the Air Force. With the backlog of resignations existing, processing in the Surgeon General's office and USAF Personnel, it isn't expected that [redacted] would be available prior to the 15 October-1 November time period. In conversation with personnel from the Surgeon General's office, it is learned that some speed-up of this processing can be achieved as requested through our liaison channels.

b. Prepare and submit a statement of work covering all aspects of this program to be added to that which covers the overall work of the prime contractor.

c. As a result of the in-flight tests being currently performed in the physiologic monitoring equipment under an existing Air Force project, a procurement specification should be written to

STATINTL

to provide three complete sets of this equipment.

d. A detailed program outline should be worked out to cover all activities entailed along with the personnel required in the implementation of this program.

e. Working through the project flight surgeon and physiologic training officer, a schedule of training runs in the mission simulator as described above should be worked out with a target date for first run not later than 21 November 1963.

8. An attempt has been made in conjunction with the chief medical officer to cost out this proposed program and a preliminary figure arrived at which would cover salaries, equipment, and simple operation, but not travel of trainee subjects came to [redacted] It should be pointed out, however, that this figure represents a fairly crude estimate, although the final figures should not exceed this by more than 40 or 50 per cent. An early reply with an indication of the ultimate decision which will be made on this proppsed program is respectfully requested.

STATINTL

[redacted]

STATINTL

clw

ACTION MEMORANDUM

SUBJECT: DATE

TO: ☐ LIFE SCIENCES ☐ BIOASTRONAUTICS ☐ SURGEON

SUBJECT: Notes for Aeromedical Equipment Conference

TO: Attendees

1. Aro-Firewell; 3 December 1963

a. Review of current O2 equipment status now in aircraft. Oxygen consumption data accumulated thus far. Comparison with data obtained on 50 chamber runs at Edwards AFB.

b. Current modification projects under way and estimated dates of completion.

c. Status of project for conversion to liquid O2 system and discuss any significant changes in ancillary equipment and/or procedures which would evolve from such a change.

d. Current planning as regards satellite operation and/or augmentation at Field Station for Blue "O".

e. Status of major improvement program for aeromedical protective equipment by Prime contractor.

2. David Clark Company; 4 December 1963

a. Review "O" suit development as a follow-on to the X-15 dash 2 configuration. Demonstrate current outfit being used at Field station and discuss fitting techniques.

b. Demonstrate possible mechanisms for undue O2 lostt from system and demonstrate possible fixes to correct the situation. Follow-up discussion to that held at Aro-Firewell on current O2 utilization data being developed at Field station.

c. Company particiipation and opinions regarding the Prime contractors major improvement program; discussion of cost and time estimates involved.

d. Current equipment modification program and estimated time to completion

e. Brief review of the "I" program equipment and the various operational evaluation programs currently underway.

f. Discussion of ventilation and protection problems involved in using the Gemini and Apollo pressure suits outside ths space vehicle.

REPORT BACK:

STATINTL

ACTION MEMORANDUM

SUBJECT: DATE

TO: ☐ LIFE SCIENCES ☐ BIOASTRONAUTICS ☐ SURGEON

g. Discussion of further work to be done at Edwards and LA on mission simulation and O2 utilization studies. Follow-on planning for ground and in-flight monitoring during training and operational phases.

h. Consideration of joint effort on future space suit~~e~~ development.

REPORT BACK:

ACTION MEMORANDUM

SUBJECT: Scheduling of Conference. DATE 7 December 63

TO: ☐ LIFE SCIENCES ☐ BIOASTRONAUTICS ☐ SURGEON

Chief, Office of Special Activities.
Attn: Deputies for Developement & Operations.

1. Oral approval has been recieved from subject office to covene a conference on aeromedical procedures and equipment in support of Field Station activities at 1000 hrs., Sunday 15 December 63 at [redacted] The conference will proceed until all items are satisfactorily covered and resolved with the [redacted] the results of the conference to the Station Commander and such other of his personnel as he may desire. The results of both conferences will represent as accurate and detailed a status report on aero - medical equipment and procedures in relation to the operational readiness date as is possible to derive from present experience and data. A written report with findings and recommendations will be subsequently furnished to the Chief, OSA.

STATINTL

STATINTL

2. The planning details of this scheduled conference are:

STATINTL

a. Attendees: Aeromedical and Personal Equipment specialists representing [redacted] Prime and sub-contractors. Confirmation of dates to the specific individuals involved should be made ASAP, preferably on 9 December 63.

b. Agenda items to be covered are as follows:

i. Presnt status and further action required on aeromedical equipment and procedures in order to satisfy operational readiness criteria & dates.

ii. Final resolution of Crew Control Procedures.

iii. Final decision on simulation program.

REPORT BACK: [redacted]

STATINTL

ACTION MEMORANDUM

SUBJECT: Conference on A/M Operational readiness. DATE 7 December 63

TO: ☐ LIFE SCIENCES ☐ BIOASTRONAUTICS ☐ SURGEON

c. Transcription of proceedings: Provisions should be made to provide facilities for tape recording of such comments as are pertinent to inclusion in the final report.

d. Previous conferences in [redacted] have been held in the [redacted] using end rooms to insure privacy. In view of the fact however, that 12-15 people may be in attendance, it may be adjudged by OSA to hold the conference in some other location. If such is the case, notification of the specific location for the conference should be given the attendees ASAP.

e. [redacted] should be provided [redacted] for all attendees requiring such, leaving at 0700 16 December 63.

f. Requested named attendees are as follows (or their authorized agents) [redacted] It is not intended that the conference be limited to these abovementioned p personnel and OSA may wish to designate other participiants and/or observers. However, there is a considerable amount of material to be covered and the consultant, at the risk of losing friends and alienating contractors, reserves the right to contain the discussion.

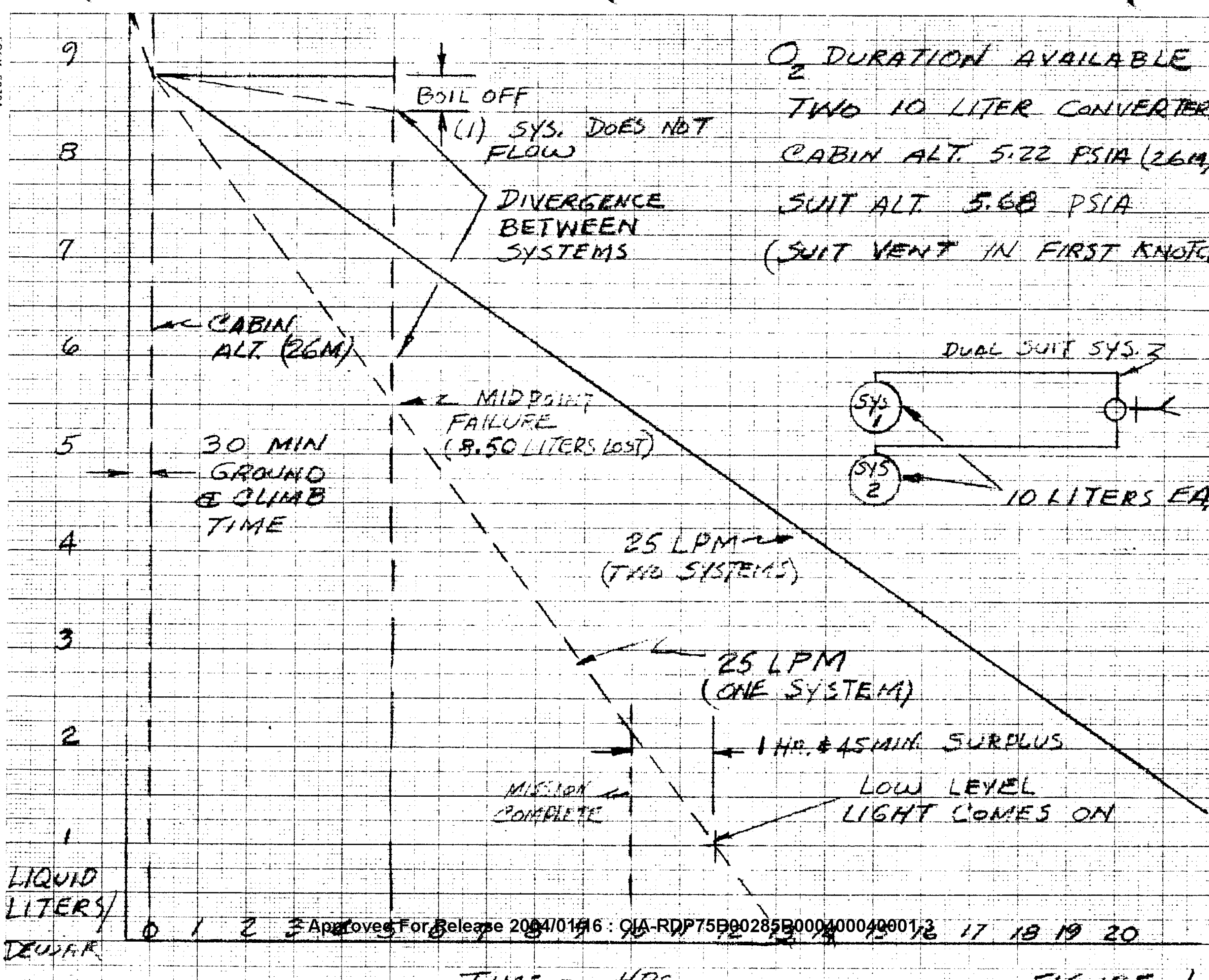
3. Request that changes to, or confirmation of, the above plan of action for the conf erence be communicated to the consultant ASAP.

[redacted]

REPORT BACK:

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

FORM 5278A



[redacted]

In answer please refer to

81-JRD:dh-342

12 December 1963

The Firewel Company, Inc.
3695 Broadway
Buffalo 25, New York

STATINTL

Attention: [redacted]

STATINTL

[redacted]

I received your letter of December 4, 1963, and read with interest your brochure from The Firewel Company. Being an ex-Buffalonian, I can remember the early days of The Firewel Company.

Our problems with canopy reflection in the Sioux Scout have to do with in-flight camouflage effects, rather than internal glare or night flight effects and probably are not similar to your visual problem.

We have discussed this briefly with [redacted] but so far have not made any progress towards developing a low reflective helicopter canopy.

STATINTL

Yours very truly,

[redacted]

STATINTL
STATINTL

[redacted]

Sioux Scout Project Engineer

STATINTL

cc: [redacted]

Meeting 16 December 1963

Objectives:

1. Status Report, Aeromedical Protective Equipment
2. Major Improvement Program
3. Simulation Studies
4. Crew Control Procedures
5. Communications

I. Status Report:

A. Oxygen System:

1. Pressure Change:

All systems have now been upgraded to 3000 psi and are cleared for use; none have been installed. Holdup has been due to gauge modifications now in progress. (below)

2. Gauge Modifications:

Only one gauge has been modified and correctly installed. This gauge is mounted vertically (gauge reading vertical); and is readable without a parallax; only objection now is poor night lighting which renders the instrument difficult to read. Once the night lighting problem is solved, new gauge faces will be made to improve reading accuracy and new gauges will be installed. New parts for installation should be available by 20 December. Estimated time for changes and installations is 3-4 weeks. [redacted] feels this constitutes no major holdup at the present time.

STATINTL

3. Oxygen Source:

Oxygen source is presently located in Mariloma, Calif. Source is adequate but requires transportation of bottles to operational area. This presents logistics problems should the project later become a satellite operation.

To avert such a problem, Firewell is developing a transportable liquid oxygen converter which should be capable of tapping off bottles at 3200 psi. This cryogenic generator should be ready for operation in 120-130 days.

4. Equalizer Valve Status:

A supplement to the September Firewell report is presently available. To replace the manual control system, Firewell has designed an orifice decay system which monitors storage bottle pressures and maintains less than a 100 psi pressure differential. This steel assembly has proven refractory to both heat and pressure changes that could be encountered in the mission profile. It's location in the system is flexible, (near reducers or at disconnects).

Firewell and LAC are to cooperate on modifications (i.e., decreasing size and weight) and installation. Estimated installation -- 120 days.

5. Bottles:

Some difficulty has been encountered in finding sufficient spare bottles to allow efficient filling and conversion to the upgraded pressure system. Martin is to take responsibility for finding spares (which are known to exist). If these are not located, he will contact [redacted] immediately so that funds can be made available for replacement. STATINTL

Firewell estimates conversion of 1800 psi to 3000 psi bottles will take some 2 weeks once bottles arrive in New York.

6. Blue "O" Liquid Oxygen System:

Firewell is presently clearing a dual system which utilizes two 10 liter converters. No pressure equalizer is necessary in this system since a single 10 liter converter can supply enough oxygen to complete a 13-hour mission. These converters have been qualified by Firewell to pressure specifications but only qualified to 165 degrees of temp. They feel sure the system will qualify at 250 degrees, and will effect same in immediate future.

New Blue birds with concerters installed are to arrive from LAC in early January.

Decision liquid versus gaseous oxygen for White "O" is still pending. LAC wishes to retain high pressure gaseous system until the Blue "O" system is proven reliable. LAC and Firewell are to cooperate drawing up a pro and con sheet on liquid versus gaseous system for White "O" Bird.

B. Pressure Suit Status:

1. Pneumatics and excessive oxygen consumption-suggestions for solution:

LAC: (1) vent pressure control

The present system delivers approximately 12 cfm from engine compressors, but this values fluctuates markedly with different altitudes and engine RPM. These flow rates have resulted in suit pressures up to 3 psi (relative to cabin pressure.) LAC suggests a valve on vent input which would maintain a vent (vent: cabin) differential of 20 in. H_2O regardless of vent flow. This system would remain capable of successfully ventilating a fully pressurized suit (3.5 psi absolute.)

(2) Vent flow regulator:

Present vent flow valve calibrations are so coarse that large increments in vent flow occur at each valve position. Suggestion is for finer orifice control allowing finer flow discrimation and, hopefully, adequate ventilation without pressurization.

(3) Decrease suit resistance to vent flow:

At present, suit pressurization is the result of suit resistance to vent flow. LAC feels that the site of greatest resistance to vent flow is at the vent outflow valve in suit controller. Removal of the water check valve at this site greatly deminishes fluctuations in suit pressures with body movement. Pressure drops across the valve are now in the order of 6 in. of H_2O instead of 2 in. they propose.

David Clark Suggestions:

(1) Determine physiologic vent flow requirements: Present fluctuations in suit pressures seem to be most marked with high rates of vent flow that results in partial pressurization. These high vent flows may be utilized to relieve helmet weight, and may not reflect physiologic ventilation requirements. Differentiation of these factors would dictate the proper approach to the problem

(2) Face Seal Configuration:

Since any increase in oxygen loss secondary to fluctuations in suit pressure requires motions of the face seal, increasing the rigity of the face seal would diminish face and chamber fluctuations. No further details.

Final Decision:

For Immediate Consideration:

(1) Due to lack of water hazard at present site, remove water check valve from suit controller vent outflow valve. Using Jack Bates' instrumentation, redetermine oxygen consumption at this lower suit resistance.

(2) Replace present vent flow regulator valves with more finely calibrated ones allowing finer selection of flow. This modification could be made within one week at Firewell plant.

Long Range Plans: Simulation Studies

2. Suit Comfort:

Some drivers are experiencing suit comfort problems. The DC representative is to stay over during present trip to help with this problem.

3. Neck Seal Configuration:

To be discontinued in favor of face seal configuration. If improvement seems a possibility, may consider for major improvement program.

4. Visor Reflectance:

David Clark investigations seem discouraging in terms of remedial coating substance. Present opinion is that total configuration of the helmet to include a face contoured visor with diminished eye to shield distance is the best approach. The present visor and helmet is operational if face reflectance is decreased by a mask, darkening, decreased cabin illumination.

5. Helmet Tie Down Cable:

Present modification allowing control with one hand is acceptable.

6. Suit Spare Parts:

Drivers are beginning to wear gloves out. Spare parts in general are going to be an increasing problem. Area requests additional contract money if needed to insure uninterrupted operation.

7. Helmet Springs:

Present springs satisfactory with exception of some minimal individual problems with size.

8. Watch Pockets:

Present modifications is satisfactory and will be sent to area during this next week.

9. Shoe Modifications:

Modification now ready for evaluation. There is some question as to the real need for any modification over original style.

II. Major Improvement Program:

All concerned recognize need for major improvements. LAC' [redacted] is to take responsibility for writing up major points in the program. Other contractors will fill in details on their specific areas of improvement.

III. Simulation Studies:

David Clark, Firewell, and LAC are all to cooperate in a single program at the Rye Canyon (?) facility of LAC. Under direction of [redacted] chamber runs simulating mission profile pressure and temperature specifications are to be effected while monitoring suit and physiologic parameters.

IV. Crew Control Procedures: [redacted]

V. Communications Problem:

Due to difficulties encountered in relaying data between area and contractor, subsequent communications will be routed through [redacted] for coordination.

DM:nc

RFZ --
23 December 1963

SPECIAL PROJECT PROGRAM

Part A - To be completed by 15 January 1964
Part B - To be completed by 1 March 1964
Part C - To be completed by 1 February 1964

(A) SUIT

(1) Altitude Flow vs Back Pressure Curves

3 Pressure Taps -
a) Seat Disconnect
b) Helmet
c) Controller

(Check locally for differential without water check?) Runs to be made at ground level, 4,300 Feet, 26,100 Feet, 25,000 Feet.

Cabin ambient flows to 50 CFM (if possible).

(2) Suit Flow Valves

a) Make up linear spool for present back pressure
b) Make up linear spool for 20" Wg pressure

Minimum pressure drop across valve required.

(3) Suit Dynamic Exercise

a) Rerun dynamic tests to determine pressure spikes using existing instruments.

b) Rerun with new measuring instruments.

c) Recheck with altered ΔP of exhalation valve and helmet regulator, and with water check out of suit.

d) Recheck with reduced ΔP controller.

(4) Helmet Regulator & Plumbing

a) Investigate means of making breathing regulator less responsive to dynamic pressure waves in the suit. However, present breathing characteristics must be retained if possible.

b) Investigate Zuck reservoir approach on the regulator.

c) Investigate Zuck report of regulator spread change with regulator back pressure outlet.

d) Exhalation valve modification, ie, compensated type, new Navy valve, etc.

e) Investigate method of reducing controller back pressure.

(5) Helmet Structure

a) Face dam modification to reduce effect of pressure spikes and waves.

b) Head bumper to move helmet with head instead of face dam.

(B) BALANCE VALVE

(1) Run qualification tests on present design.

a) Examine principle test areas under environmental.

b) Continue functional performance as possible.

(2) Redesign valve to meet full fail safe regime.

a) Valve now shuts off good side when one side fails to flow.

b) Other failure mode, loss of pressure, the valve compensates.

c) Design of valve must be such that valve does not fail full dual system. Preferred design of balance valve is failure of valve affects neither sub-system.

d) Investigate potential of spring loaded seat to reline flow stoppage failure. Martin will consider a sub-system differential of 500 psi to power a by-pass system.

e) Investigate mounting valve on the oxygen control panel.

(c) HIGH PRESSURE SYSTEM

(1) All affected components and system to be requalified to 3000 psi operating pressure. Similarity will be accepted where possible.

ACTION

Part A -- 1) 2) 3) 4) 5) [redacted] STATINTL

Part B -- 1) 2) [redacted] STATINTL

Part C -- 1) [redacted] STATINTL

STATINTL

hc: [redacted]

AM 990

24 December 1963

P. O. Box 2605
Buffalo 26, New York
14226

STATINTL

Dear [redacted]

STATINTL

As discussed in the meeting on December 16th, there are several areas requiring resolution between [redacted] people, STATINTL [redacted] and ourselves. Most of these areas of differences were resolved in further discussions on the 17th and 18th.

As agreed to by all parties, we have met the basic parameters of ventilation requirements, that is volume versus back pressure, for the full pressure suit system as agreed upon four years ago. However, the equipment is not being operated at design parameters. The Drivers are calling for higher flow volume to compensate for the higher flow temperature. We have STATINTL agreed with [redacted] to perform additional work and studies in this area to be completed by the 15th of January 1964.

(A) SUIT INVESTIGATION

(1) Suit Flow Tests

We will develop information in our chamber that will permit us to determine the exact vent flow volume being used by the Drivers.

(2) Suit Dynamic Exercise

STATINTL Information from [redacted] indicates that there is more torso motion expected than we anticipated, therefore, we will re-run the suit dynamic motion studies.

(3) Helmet Plumbing and Regulator

We will investigate means of making the regulator and associated plumbing less sensitive to suit pressure waves. Helmet suit differential and control valving will be included in this investigation.

(4) Helmet Structure

The affect of a stiffer face dam and better means for moving the helmet through head motion will be studied.

(5) Vent Flow Valve

We are sending a new more linear vent flow valve to the area for evaluation.

(B) EQUALIZER VALVE

STATINTL

As reported at the meeting, we have completed the major share of development work and performance tests on the Equalizer Valve to balance the dual oxygen system. Further discussions with [redacted] and his engineers brought out the fact that there is a possible failure condition which the valve does not now meet. The valve balances well within the 200 psi differential allowed and compensates for the loss of pressure in one system. However, it does not compensate for the failure where pressure is retained in the system but flow is stopped. These two failures are direct opposites in action. We will continue our development work on the basis of discussions and agreements with [redacted] STATINTL

(1) We will run qualification and environmental tests on the valve.

(2) We will redesign local components in the valve to meet the flow stoppage failure condition.

(3) We will investigate valve configuration to incorporate it in the oxygen on-off panel.

(C) HIGH PRESSURE OXYGEN SYSTEM

As agreed on at the meeting, the high pressure oxygen supply has been increased from 2800 psi to 3000 psi.

(1) We will requalify to the 3000 pound pressure the system and components as required using similarity to previous tests as a basis whenever possible.

(2) We will up-grade components as necessary. However, our initial discussions indicated that no hardware modifications will be necessary except changing the reducer pressure schedules.

24 December 1963

(D) LIQUID OXYGEN FOR VEHICLES 132 & 133

Contrary to what I said at the meeting, the standard oxygen converters are qualified to an operating temperature of 260°F in accordance with the latest specification controlling this equipment. We are at present reviewing the schematic for the liquid systems to make sure that all services can be performed in accordance with required operating conditions. This includes fill, purge, drain, pressure test, etc., for both converter system and vehicle tubulation.

(E) SYSTEM HARDWARE UP-GRADING

As mentioned in the meeting we are having some difficulty in arranging for the return of hardware from the field for upgrading at the plant. [redacted] volunteered to push this problem from his end. In the next few days we will be supplying Ed a document identifying all individual components involved.

STATINTL

Our present schedule, as determined in our meeting on the 18th with [redacted], calls for the completion of Items A, C, and D by the 15th of January. We are anticipating a meeting with [redacted] and his engineers shortly after that date to review the data we developed.

STATINTL
STATINTL

STATINTL

Very truly yours,

[redacted]

STATINTL

p

cc: [redacted]

SUBJECT: Summary report of Aeromedical conferences. DATE 24 December 1963

TO: ☐ LIFE SCIENCES ☐ BIOASTRONAUTICS ☐ SURGEON

Chief, OSA.

1. Previous communications to your office on the subject of the operational readiness of project aeromedical procedures and equipment have enumerated the activities undertaken and the personnel involved during the past 6 weeks in order to establish a year-end staus report on these matters. The final conference was held 15-16-17 Dcember at the Field Station and environs and yielded the following statements and concurrences:

a. High pressure O2 system (3000 psi): all tanks and components have beendeveloped and will be fully qualified for production and installation in 90-120 days. A schedule has been prepared by the prime and sub-contractor for retromodification but to date this schedule is not being met due to an apparent lack of spare parts, the whereabouts of which are to be determined by prime and sub with subsequent action being taken by them to correct the current lag in the retromod schedule. The equalizer valve has been tested and developed by Firwell and it betters its performance specs by 100% (specs called for bleeding down both systems with no greater pressure differential than 200 psi; current valve bleeds down with no greater differential than 100 psi.) Prime and Firwell will extend further testing to include the developement of a smaller and lighter article.

b. Full pressure protective suit assembly: Bulk of current complaints center around bulk and discomfort of the entire rig with the problem of visor reflectance still of greatest concern as regards in-flight performance by the drivers and operational personnel. Altho most personnel believe that the stated mission can be performed satisfactorily with the present equipment, it is generally felt that the sheer bulk and weight of the equipment will impose unecessary burdens upon the drivers during an actual operational mission. Some of the immediate fixes which have been underway these past 6-8 mos may provide significant alleviation of these adverse factors. These include the neck spring to reduce the weight of the helmet on the head; improved suspension and ear cushions; reworking of the aircraft-suit vent system to alleviate ballooning of the suit; re-packaging of theWASS to provide a more comfortable and broader seating area. All personnel are agreed that the optimal and desired degree of driver-operational efficiency can only be obtained by vigorously pursuing a 'major improvement program on the protective equipment assembly.'

REPORT BACK:

STATINTL

SUBJECT: Aeromedical Conferences; Status report. DATE 21 December 67

TO: ☐ LIFE SCIENCES ☐ BIOASTRONAUTICS ☐ SURGEON

c. Oxygen utilization studies: Further measurments made at the operational area, although understandably crude, have indicated that an acceptable figure of 17.o LPM average for all drivers has been fairly well established; although it should be remembered that until actual training flights of operational duration and complexity are undertaken, we cannot place full reliance upon these figures. Tyhere can be little doubt from the preliminary studies made by both Firewell and Clark that the current vent system with its over pressures and gradients is at least partially responsible for unecessary losses of oxygen and a meeting was held between the prime and these two subs on 17-18 December to work out in detail the mechanical and pneumatic details of this problem and come up with firm recommendations for further testing which will elucidate both the specific factors involved and thusly the corrective action needed to be taken.

d. Instrumentation (driver & equipment) and simul ation studies: All personnel are agreed that in order to resolve the questions of driver-performace degradation and oxygen consumption it will be necessary to carry out simulated missions of required operational duration with the driver outfitted and instrumented in an altitude chamber where the pressure and temperature profiles can be accurately reproduced. The physiological monitoring equipment would be designed to be usable in actual training flights in order that a valid comparison could be made between the ground and air-borne situations. Thus far we have planned to use the prime contractors facility with the instrument packages developed by Beckman instruments with a rough estimate of total costs involved coming to around 100,000 dollars. A further refinement of these figures is currently under preparation.

e. Aircrew control and maintenance procedures: As a result of reviews at headquarters of the proposed plan, command post excercises carried out at the field Station plus several detailed conferences on the subject, it was agreed that the original plan submitted by the operational unit would be redrafted and submitted to hq for furthe r consideration. Meanwhile, in private discussions with key OSA and Air Force personnel at the Station it has been agreed that all pilot personnel using the equipment should be required to conform to the prescribed control and maintenance procedures. All of us recognize the fact that the prime boss man and his company pilots are spring-loaded in the "OFF" position on this subject but nevertheless still feel that such a universal driver control program should and can be established with the judicious help of the the primes flight surgeons.

REPORT BACK:

AM-991

26 December 1963

P. O. Box 2605
Buffalo 26, New York 14226

Dear Joe:

As discussed at the meetings on December 16th and 17th, we are programming a considerable amount of effort on the suit and hardware areas to attempt to minimize oxygen consumption. The enclosed letter to [redacted] will give you an idea of the areas we are investigating. Most of these areas were agreed to at the meeting with [redacted] on December 18th.

We would like you to continue the work you started in the area of stiffer face dam design and material. It was reported that you are able to reduce drastically, the affects of suit pressure waves on oxygen consumption through stiffer face dams. It is our opinion that this work should be continued as it can have a great affect on reducing non-breathing losses. At the same time, we are going to experiment with what we call a head bumper in the helmet to move the helmet through direct structural contact rather than relying entirely on the face dam web.

While it did not come under discussion at the general meeting on Monday, I believe all involved are greatly concerned about the face piece reflectance problem. It is mandatory that we keep all necessary efforts going on this problem to resolve it as quickly as possible. If you require or would like assistance from us we will be happy to make an engineer available.

At the meeting on December 16th, you stated you had no experimental or development helmet to use for investigation purposes. Proceed immediately to make a helmet for this usage.

STATINTL

[redacted]

AM-991
26 December 1963

STATINTL

After we have completed the suit test work indicated on the attached schedule, we will be returning [redacted] suit for up-grading. We have found salt deposites in the helmet tubulation. In some tests this has presented a problem. In particular, we would like the neck ring changed to the ring that is the current standard. If the ring cannot be changed we would like to consider making a new helmet for this suit as we believe we should have the latest configuration available for test and development work. If it is necessary to make the new helmet for Harry's suit assembly, would it be possible for you to rework the existing helmet for your development and test work?

Very truly yours,

[redacted]

STATINTL

p

STATINTL

Encl.

cc: [redacted]

STATINTL To : [redacted] Date : December 30, 1963

STATINTL From : [redacted]

Subject : Oxygen Consumption Problems

Meetings on December 17 and 18 between David Clark, Firewel, and ADP yielded the following results.

1. Lockheed to make new regulator for suit vent pressure at 20" H_2O and approximately 12 CFM.

2. Firewel to make a new filter control vent valve on the suit. Two prototypes available December 26.

STATINTL 3. [redacted] has removed water check valves to flight test lower pressure drop possibilities. To be done immediately.

4. Firewel to conduct tests to establish validity of CFM vent flows with various pressures equivalent to practical aircraft conditions. Should be done and documented by January 15.

5 A. Result of these tests may be to open up the suit controller to reduce pressure drop across it.

B. If vent flows are low and thus suit controller pressure drops are low, then equipment should stay as is.

5. David Clark and Firewel to work on face dam problems to make stiffer or support helmet better in order to alleviate pressure pulses in face area which cause oxygen wastage. Should be done and documented by January 15.

6. Lockheed and Firewel to work on dampers to apply to the breathing regulators to desensitize them so that suit pressure pulses cannot waste oxygen. Should be done by January 15.

7. Firewel to continue work on the oxygen equalizer to eliminate ADP objections to emergency conditions which could cause complete loss of onboard oxygen. Should have answers to evaluate by January 15.

8. Firewel to attempt to work this equalizer into the oxygen control panel to alleviate installation problems. Drawings to check by January 15.

9. The LOX dewars to be used on two articles are qualified to 260°F and thus are usable in our wheel well area. We may have to obtain these dewars from the Navy since only 400 were procured by the Air Force. We are proceeding immediately to install these.

As you can see, some problems will be solved and many answers available by January 15.

STATINTL

kld

STATINTL

cc:

1964

axc-6305
COPY 3 OF 3

4

January 7, 1963

Dear John:

Subject: Thinner, Lighter Parachute

Now that we have developed a dependable parachute that covers our complete aircraft performance, something incidentally, that no other high performance aircraft program can claim, we must heed our pilots' criticisms with regard to comfort and mobility.

With this in mind, we have developed and mocked up a new thinner, lighter parachute which retains all of the performance characteristics of the present parachute. You will see that this new parachute makes full use of almost all of our presently developed hardware and as a result requires a fairly small, safe development effort to get it into production.

Two recent developments make it almost mandatory that a decision on future parachute configurations be made immediately. They are:

1. The fact that we should pull out of [redacted] for security reasons and go to a new parachute source. STATINTL

2. The possibility of building many more parachutes; which should not be to an uncomfortable configuration.

With this in mind the following desired improvements are included as the result of operational usage comments and experience. The comfort improvement features were again emphasized by several board comments on our recent R-12 Mockup Conference.

1. Remove parachute restriction, stiffness, and weight off of pilot's shoulders.

2. Move pilot back on seat cushion.

3. Provide more pilot leg room.

4. Improve chute deployment - more pull force on rip cord pins.

5. Eliminate present free-fall, which could be 1600 feet maximum.

6. Relocate green apple to right hand side and incorporate the emergency oxygen pressure gauge for inflight viewing.

7. Improve zero lanyard actuation. Reduce hazard of pilot to seat collision on man/seat separation.

8. Reduce parachute weight by six pounds.

9. Provide an individually fit parachute support spacer relieve chute weight. Allows pilot freedom of movement.

10. Improve maintenance and service life of parachute and timers.

    a. Reduce number of timers. (Two in lieu of three.)

    b. Provide re-usable harness when container is replaced.

    c. Direct rip cord routings provide most reliable system in service.

The basic changes to obtain the above involve a repacking of the assembly in order to reduce its thickness, a redesigned torso harness, and an integrated timer/oxygen pan. The parachute itself, drogue and main, are not changed - merely repacked. Table I illustrates the current and proposed hardware with regard to sources and modifications required.

A mockup of the improved parachute configuration has already been approved by our pilots. They would like to have it as soon as possible. We have refrained from demonstrating the improved parachute to your or [redacted] pilots until we reach an agreement as to our course of action.

STATINTL

We have mapped out a development schedule that will produce the initial flight-worthy parachutes in April 1964. This program is shown on Table II. A preliminary estimate of the development test program costs indicates that [redacted] is involved for hardware and engineering costs. This does not include the Air Force costs for [redacted] and El Centro tests, which we cannot judge.

STATINTL

STATINTL

TABLE I

HARDWARE SOURCE

STATINTL

ITEM		CURRENT	PROPOSED	COMMENTS
Parachute Container				
Parachute Harness				Extensive Mod, requires El Centro Tests
Parachute Main Canopy				Identical
Parachute Drogue Canopy				Identical
Timers	Drogue Release			Slight Mod
	Drogue Jettison			Not Required
	Main Release			Requires Qualification Tests
Oxygen	Reducer	Firewel	Firewel	Reduced from 2 to 1
	Bottles (3)	Firewel	Firewel	Reduced Bottles from 6 to 3
	Green Apple	Firewel	Firewel	Gauge moved to Apple
Quick Release Main (2)				Identical
Drogue Jettison (2)		Firewel	Firewel	Identical
Double Footman				New Item
Timer & Oxygen Pan Assembly		Firewel	Lockheed	New Item
Parachute Assembly & Pack				
Manual Main Release				Identical

STATINTL

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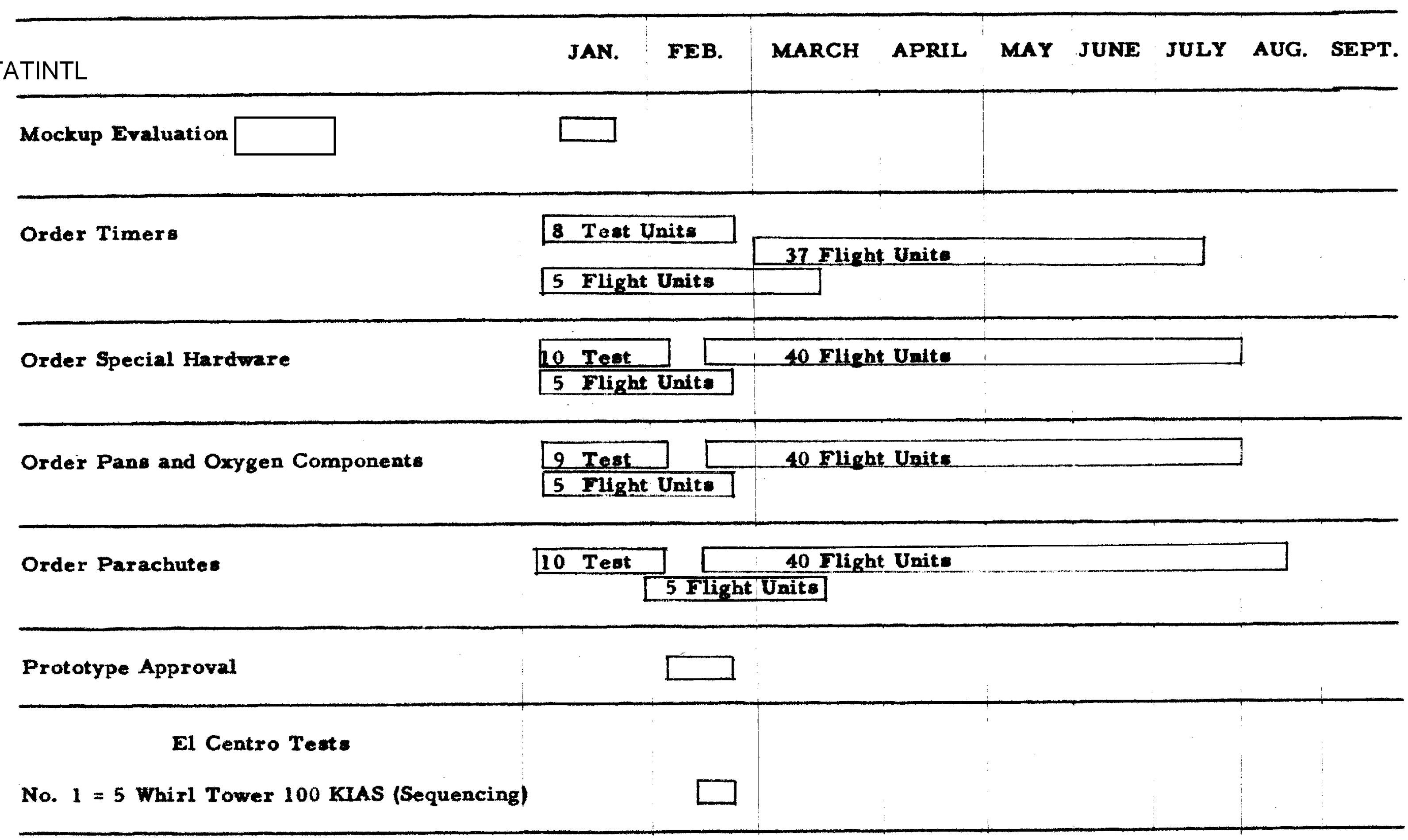
TABLE II
DEVELOPMENT SCHEDULES

STATINTL



DEVELOPMENT SCHEDULES (Cont'd)

	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.
No. 2 = 1 Drop Tower Drogue (7000 lbs)		☐							
No. 3 = 1 Drop Tower Main (7000 lbs)		☐							
No. 4 = 1 Whirl Tower 100 KIAS (Main)		☐							
No. 5 = 1 Whirl Tower 300 KIAS (Main)		☐							
No. 6 = 3 Drops from A/C 300 KIAS at 20,000 Ft.		☐							
No. 7 = 1 Live Jump		☐							
STATINTL [redacted] Tests Qualification - Comb. Main & Drogue Timer		☐							
STATINTL [redacted] Tests 2 - Ejections "Low & Slow"			☐						

[redacted]

STATINTL

January 9, 1964

Dear Harry:

Subject: Sponge Rubber Spacer to replace present Rigid Spacer on top of Kit

As a result of pilot complaints regarding the effort required to lean forward, we have been using a sponge rubber spacer between the parachute and the survival kit instead of the rigid spacer as supplied.

This is made up of 6 layers of 1" thick sponge rubber encased in a fabric cover. The shape is such that it fits between the aft edge of the seat cushion and the back of the seat.

The density of the rubber is such that the weight of the parachute compresses the 6" to about 3".

At 3.5" compression the spacer is exerting about 50 lbs. of upward pressure and at 4" about 30 lbs.

This means that as the man leans forward and tries to lift the parachute off the kit he is getting assistance from the spacer.

The spacer is hand tacked to the aft end of the seat cushion.

We make no claims as to the originality but feel that the sponge gives good results and is less apt to cause back injuries during some of the bail out attitudes.

To date we have only used these with our pilots. Since you and [redacted] control your survival kits and seat cushions, I would recommend that you have this modification made to your equipment.

STATINTL

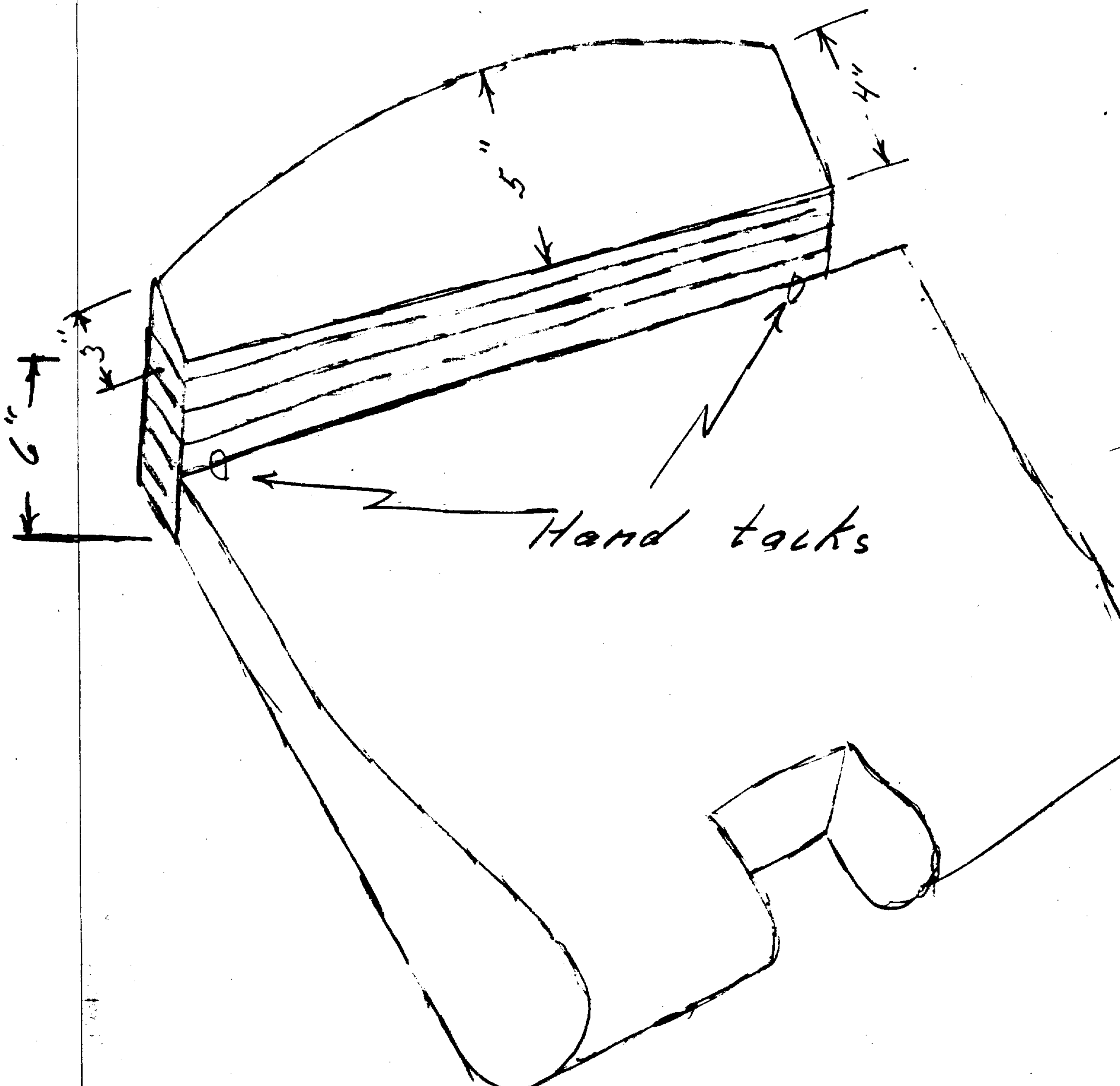
I have taken the liberty of sending copies of this letter to [redacted]

 [redacted]

Best regards,

[redacted]

kld



Approved For Release 2004/01/16 : CIA-RDP75B00285R000400040001-3

AM-1023 A

17 January 1964

P. O. Box 2605
Buffalo 26, New York 14226

STATINTL

TO: [redacted]

Dear Ed:

During our meeting of December 17th, we agreed to accomplish a number of tasks by January 15th. At this time we are not completely finished but we ~~do have a~~ large share of the tasks completed.

STATINTL

The new suit vent flow valve, requested by you, was sent to [redacted] and has been flown. [redacted] reports better vent flow control with this new model, however, this valve design problem cannot be totally resolved until the back pressure control is installed in the vent system. STATINTL

We have partially completed the suit dynamic exercise work with varying results on modifications and new approaches. Part of this work is being held up until we check out the compensated exhalation valve installations in the helmet.

STATINTL

We have investigated means of reducing sensitivity in the breathing system. One of our principle investigations was [redacted] reservoir approach. This approach affected the breathing characteristics to the point where we have serious reservations about future work in this area.

We have come up with a method of reducing the suit controller back pressure for the conditions which we have examined. As you have inferred in the past, we believe that a lower controller back pressure will reduce the affect of the dynamic pressure spikes on oxygen usage.

STATINTL

I discussed helmet face dam modification studies with [redacted] yesterday. He has not made the progress that we would like in this area but expects to have additional tests completed some time next week. The tests that we have run on rigid and semi-rigid head bumpers, to minimize the motion differential between helmet and face dam, have been insignificant.

[redacted]

AM-1023
17 January 1964

In checking our altitude chamber ventilation system for flow volume we found that we are lacking capacity as we are interested in getting flows up to 50 CFM. We believe this restriction has been corrected with the modifications made, unfortunately, [redacted] showed up a week early tying up our chamber until the first part of next week. These altitude flow versus back pressure curves should require only one or two days of actual test work.

We have requalified all affected components in the high pressure system to the 3000 psi pressure. We experienced no difficulty with any item and at the present time believe the only change will be to raise the pressure schedule a few pounds. The reports are now being prepared on these tests.

[redacted] has been successful in mounting the balance valve in the panel envelope given us by [redacted]. We are proceeding to make a sample of this unit for evaluation purposes. A feature added to the assembly is a manual controller on the balance valve, something which we did not have before, however, to date we have not been able to generate a means to compensate for the failure mode of flow stoppage but retention of system pressure.

Your suggestion of using a constant by-pass or a pressure actuated by-pass was investigated and found not to answer the problem satisfactorily. In checking the constant by-pass we found that a 5 SLPM constant flow by-pass resulted in a system pressure spread of almost 200 PSI before stabilization. This compares to the 60 PSI pressure spread of the existing valve. Tests using a 10 SLPM constant by-pass were stopped after the system pressure differential reached 400 PSI.

Your suggestion of a pressure actuated by-pass, using increased or greater sub-system pressure for actuating, was considered. However, once the system in which flow has stopped shuts off the good or lower system, no further pressure decay occurs in either system. Therefore, there is no increasing pressure differential for actuation or for use as a signal.

We are continuing our efforts for a total fail-safe design of the balance valve. All of our ideas and approaches to this problem solution had negative results. If you or Dan have additional suggestions we would certainly appreciate them.

STATINTL [redacted]

AM-1023
[illegible] January 1964

We are pursuing all uncompleted areas and expect to have all tests completed the week of the 27th.

Do advise me as to the possibility of getting together to discuss the results of the work we are doing and applications of design changes.

Very truly yours,

[redacted] STATINTL

STATINTL p

cc: [redacted]

PROGRAM STATUS

I. Area of Responsibility

General definition -- man associated problems. Specific areas are (a) Life Support, (b) Safety and Comfort, (c) Testing and Indoctrination, and (d) Personal Equipment.

These specific areas have developed into:

1) Oxygen System and Vent Control components, primarily components and integration into the airframe.

2) Full Pressure Suit and Control Hardware

3) Associated Flight Equipment, Survival Kits, Parachute, Emergency Oxygen System

4) Ground Support Equipment - Vans Transporters, Test Equipment, Ready Room Equipment, Walk-Around Equipment

5) Field Activity Support Personnel - Oxygen and Personal Equipment Technicians, Full Pressure Suit Technicians.

(1) Oxygen System (Dual High Pressure)

a) Recently requalified from 2800 PSI to 3000 PSI. Report being written. Problem area -- hardware turn around for up-grading.

b) Oxygen supply capacity presently installed not great enough to provide MIL spec 25 LPM over mission range. Additional high pressure supply being investigated as well as feasibility of liquid oxygen storage.

Studies are being made on suit, suit hardware, vehicle systems to attempt to reduce safely the usage rate of oxygen to reduce the oxygen storage requirement. Oxygen usage is being studied to determine amounts lost through leakage as well as normal consumption, added consumption through added mental and physical tasks.

c) Balance of dual high pressure system required to insure mission completion. Systems do not have inherent capability for self balance contrary to original analysis.

d) Vent flow hose and disconnect assembly under design change due to actual field usage being different than original intention. This is principally in disconnect area related to frequent removal and reinstallation of unit from seat.

Late problem developing in suit end friction disconnect break load dropping off through usage. Revision is necessary to eliminate this plus to meet requested change of parting load.

(2) Full Pressure Suit (Joe R.)

a) Comfort - Fit problems being worked on by Joe R. [redacted]. Helmet face piece reflectance - clear wired not yet evaluated as it does not fit the standard helmet too well - sealing problems. New gloves being ordered for all company drivers.

STATINTL

b) More dynamic motion tests run at Firewel. Data being prepared for evaluation. Altitude flow tests run in Firewel chamber - data being prepared for evaluation.

c) Helmet regulator sensitivity tests run to examine means to compensate to reduce affect of suit pressure waves. Results show breathing characteristics greatly affected. Any change which will effectively reduce O_2 flow from suit pressure waves or spikes will cause regulator to go negative on breathing inspiration.

d) Design of suit mounted vent flow valve could change depending on results of new vent air control. Present vent air flow and pressure excessive. Three (3) valve models presently available for evaluation.

e) A compensated exhalation valve is currently being tested. Initial results indicate no improvement.

(3) Associated Hardware

a) Parachute qualification program still has tests under consideration [redacted]. STATINTL

b) Emergency Oxygen System pressure settings have been studied for resetting. Problem exists of local over-lap with ship's system. Modification and improvement made make shift of Emergency O_2 pressure settings to low enough setting to eliminate over-lap but retain minimum pressure required for breathing performance and face piece seal inflation.

c) Survival Kit in short supply. Only fifteen (15) ordered under contract. Possible revision forthcoming on riser pad to accommodate movement of driver in seat.

February 4, 1964

Dear John:

Subject: Lightweight Helmet with Oxygen Mask

At our meeting of January 29, we arrived at a consensus of opinion that we should pursue the development of the oxygen mask concept in order to eliminate many of the pilot's valid operational criticisms of the present full pressure suit. I would like to suggest a program to build prototypes of this concept for our pilots to use as soon as possible.

While it is true that we demonstrated a working system of oxygen mask and full pressure helmet, we are not equipped in our shop to do this particular type of development work as well as David Clark or Firewel. I believe that David Clark should develop the mask and helmet. They should work with Firewel to match the dual breathing regulators and qualify the system in Firewel's tank test.

Since this program is primarily only that of marrying known hardware items, I would expect it to go rather rapidly. We should have prototype helmets in 90 days. If David Clark requires a good source for a lightweight molded fiberglass helmet shell, we can supply this component. The attached table indicates practical goals for the lightweight helmets.

To implement this program, David Clark should do the following:

1. Make a lightweight helmet using the present neck ring. This will permit direct interchangeability with present suits.

2. Include a single visor aneroid operated to close at 30,000 feet altitude pressure.

3. Visor to be tinted for glare.

4. There is to be no face dam - some vent air is permitted to exit around face.

5. Install a light comfortable mask connected to dual pressure regulators in the helmet.

6. Mask to eventually have inflight feeding port.

7. Size the vent hoses to the helmet in order to restrict the flow across the face and to permit operation of the suit vent valve.

Similarly, Firewel on their part should do the following:

1. Cooperate with David Clark in matching the breathing regulators to the mask.

2. Conduct qualifying tests in their chamber of the mask and lightweight helmet combination.

I would like to monitor this program very closely and make use of our pilots during the prototype stage in order to assist arriving at a suitable combination of hardware.

With regard to the aircraft portion of the oxygen system, we are not too far from having a completely satisfactory system. The addition of the equalizer valve, which we are building, should be the last modification.

Firewel should stop all work on the valve they are proposing. It has inherent dangerous characteristics which are unacceptable. All other Firewel equipment in the airplane's oxygen and nitrogen systems is now working satisfactorily. In fact, it usually is pretty good.

I believe this concept will go a long way towards making our pilots more comfortable and thus ensuring a greater success of our very tough mission. I would recommend that this program be pursued.

Sincerely,

STATINTL

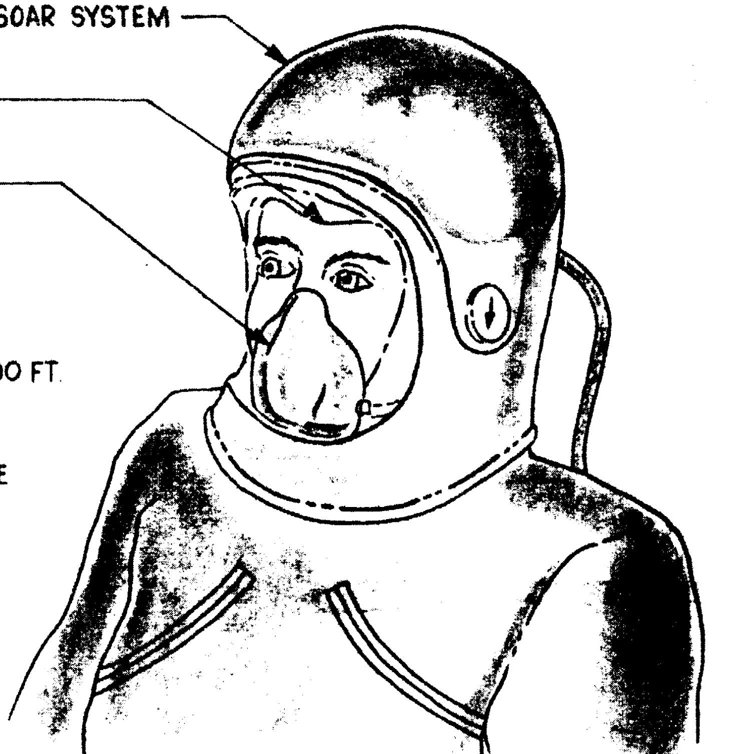
Enclosures:
1. Table of Helmet Weights
2. Proposed Operational Suit Configuration

TABLE OF HELMET WEIGHTS

	PRESENT	LIGHTWEIGHT
NECK RING	.28	.28
VISOR, OUTER	.40	.40
VISOR, INNER	.94	0
EARPHONES, ETC.	.85	.60
REGULATORS	.88	.88
BARRIER	.50	0
SHELL	2.50	1.25
ANEROID MECHANISM	0	.50
	6.35 lbs.	3.91 lbs.

PROPOSED OPERATIONAL SUIT CONFIGURATION

1. FLY MISSIONS WITH VISOR RAISED AS IN DYNASOAR SYSTEM
2. ELIMINATE FACE PLATE REFLECTIONS
3. ELIMINATE FACE SEAL & CHAFING
4. IMPROVED HEAD VENTILATION BY FACE
5. ELIMINATE EXCESSIVE OXYGEN CONSUMPTION BY USE OF MASK
6. DECREASE SUIT VENT BACK PRESSURE
7. ELIMINATE FACE PLATE FOGGING & HEAT OBJECTIONS
8. CLOSE VISOR IF CABIN ALTITUDE REACHES 30,000 FT.
   A. MANUALLY (COCKPIT MANUAL LIGHT)
   B. AUTOMATICALLY AS IN DYNASOAR
9. COMFORTABLE LOW PRESSURE MASK POSSIBLE BECAUSE OF LOW CABIN OR SUIT PRESSURE DIFFERENTIALS
10. MOVE BULKY ZIPPERS FROM CHEST TO BACK



MOD. IMPROVEMENTS

PROBLEM AREAS

DURATION OF OXYGEN SUPPLY

A. IMPROVEMENT AREAS

1. GREATER SUPPLY
2. ACCEPT LOWER PARAMETERS FROM EXPERIENCE
3. MINIMIZE NON-BREATHING OXYGEN USAGE

    a. SUIT AREA

        REGULATOR SENSITIVITY

        EXHALATION VALVE

        SUIT CONTROLLER BACK PRESSURE

        HELMET FACE DAM

    b. VEHICLE AREA

        VENT AIR FLOW REGULATOR

        MODIFICATION OF SUIT FLOW VALVE

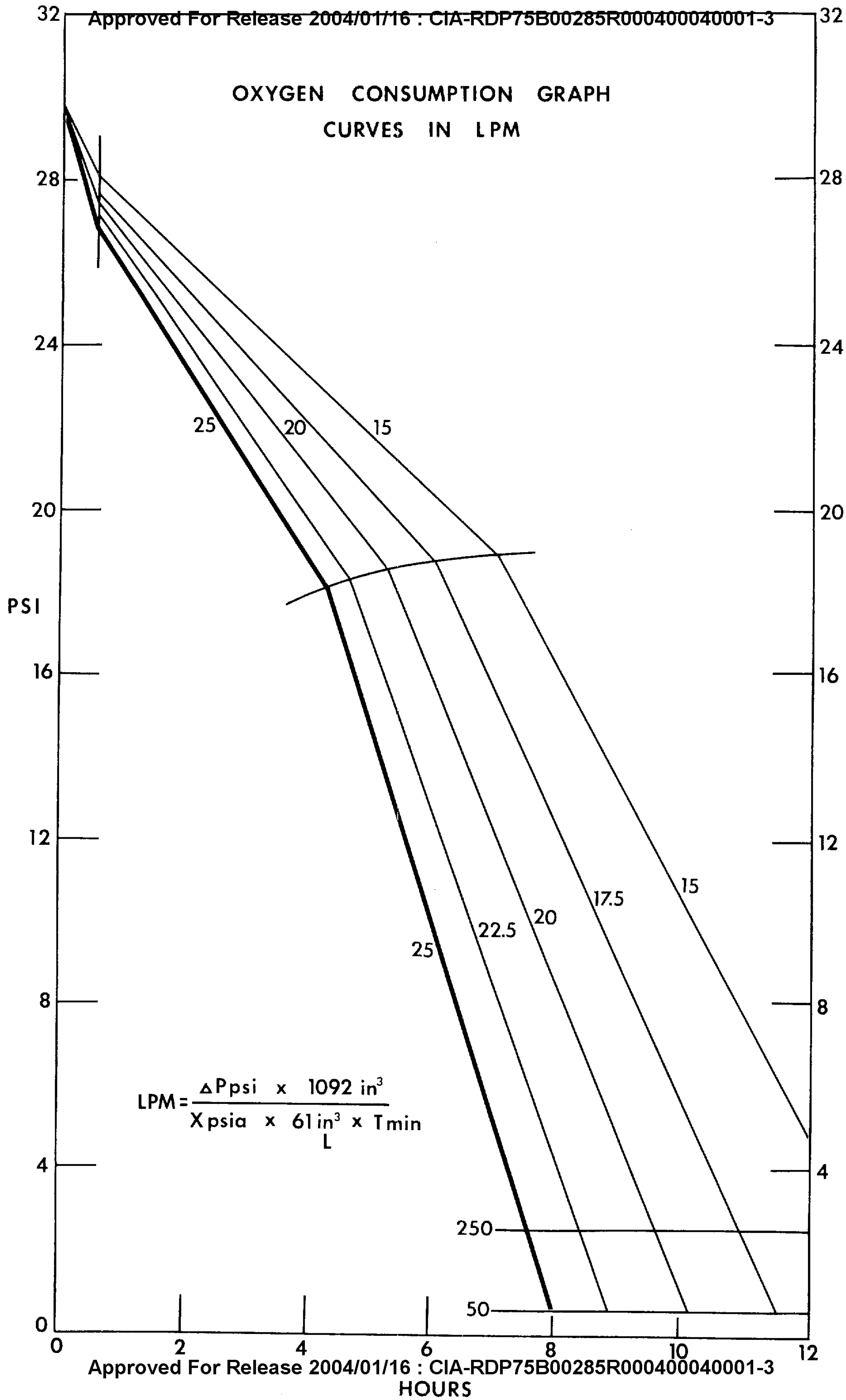
B. SYSTEM BALANCE

1. NORMAL FLOWS UNEQUAL
2. EQUALIZER DEVICE NECESSARY
3. EQUALIZER FUNCTIONALLY DEVELOPED

    a. PACKAGED TO MOUNT ON PANEL

    b. MANUAL OVER-RIDE INCORPORATED

4. ALTERNATES



$$LPM = \frac{\Delta P psi \times 1092\ in^3}{X psia \times \frac{61\ in^3}{L} \times T min}$$

PILOT RECOVERY SYSTEM

REQUIREMENTS

SAFE ESCAPE ON DECK AT 65 KNOTS

THRU ALL PROGRAM SPEEDS & ALTITUDES

UP TO

SYSTEM & SUB-SYSTEM TESTING

DROP TOWER

WHIRL TOWER

AIRCRAFT

a. EMERGENCY OXYGEN SYSTEM

b. AUTOMATIC ACTUATORS

c. SURVIVAL KIT

LIVE JUMPS

a. LAND

b. WATER

EJECTION SEAT TESTS

PILOT RECOVERY SYSTEM

DEVELOPMENT OF
STABILIZATION PARACHUTE

CONFIGURATIONS TESTED

- 51" GUIDE SURFACE
- 60" GUIDE SURFACE
- 78" FIST RIBBON HEMISFLO 35% POROSITY
- 78" FIST RIBBON HEMISFLO 21% POROSITY
- 60" FIST RIBBON HEMISFLO 35% POROSITY
- 60" FIST RIBBON HEMISFLO 21% POROSITY
- 40" FIST RIBBON HEMISFLO 21% POROSITY
- 3 FOOT DIA. BALLOON
- 4 FOOT DIA. BALLOON
- $4\frac{1}{2}$ FOOT DIA. BALLOON
- 78" FIST RIBBON

PRESENT PARACHUTE

PILOT COMPLAINTS	DESIRED
COMFORT & MOBILITY	
1. THICKNESS – 6½"	THICKNESS – 5"
2. HARNESS WEIGHT AND RESTRICTION IN SHOULDER AREA.	REDUCE
3. TORSO MOVEMENT DIFFICULT.	RESPONSIVE PARACHUTE SUPPORT SPACER.

OTHER DESIRABLE IMPROVEMENTS:

- ELIMINATE FREE FALL BETWEEN STABILIZATION CHUTE RELEASE AND MAIN PARACHUTE DEPLOY.
- ELIMINATE GOOSENECKS IN PRESENT CABLE ROUTING.

PROPOSAL

1. INCORPORATE IMPROVED ACTUATORS AND EMERGENCY OXYGEN IN NEW PAN.
2. DO NOT MODIFY HARNESS OR PACK.
3. THOROUGH INVESTIGATION TO PROVIDE OPTIMUM PARACHUTE SPACER BLOCK.
4. STUDY OF WAYS TO IMPROVE SEAT CUSHION FOR INDIVIDUALS.

ADVANTAGES

- SAVE 200 CU. INCHES WHICH WILL PROVIDE THINNER PACK.
- VERY LIMITED TEST PROGRAM.
- NO RQMT FOR NEW HARDWARE DEVELOPMENT.

DISADVANTAGES

BULK REMAINS IN SHOULDER AREA.

RESULTING ADVANTAGES OF PROPOSED MODIFICATION

1. THINNER CHUTE — NEED 1½"
2. ELIMINATION OF FREE FALL BETWEEN STABILIZATION CHUTE RELEASE AND MAIN CHUTE DEPLOY.
3. REDUCED BULK IN SHOULDER AREA.
4. REDUCED WEIGHT.
5. PACK REPLACED WITHOUT REPLACING HARNESS.
6. MORE POWER ON RIP CORD PINS VIA MORE DIRECT CABLE ROUTING.
7. ELIMINATE GOOSENECKS.

RESULTING DISADVANTAGES OF PROPOSED MODIFICATION

1. REDUCTION IN STRENGTH OF PARACHUTE.

2. EXCESSIVE COST FOR PRODUCING NEW HARDWARE.

WAYS TO REDUCE PARACHUTE THICKNESS

1. ELIMINATE DUAL EMERGENCY OXYGEN SYSTEM — CAPACITY 120 CU. INCHES — AND REPLACE IT WITH SINGLE SYSTEM — CAPACITY 60 OR 80 CU. INCHES.

2. INCORPORATE STABILIZATION PARACHUTE RELEASE AND MAIN PARACHUTE DEPLOY INTO ONE DEVICE — —PRESENTLY TWO— .

3. REDESIGN PAN INCORPORATING 1 & 2 ABOVE.

EL CENTRO TESTS

NO. 1 10 WHIRL TOWER (SEQUENCING)

5 - 100 KIAS
2 - 200 KIAS
3 - 300 KIAS

NO. 2 3 DROP TOWER DROGUE (6000 LBS)

NO. 3 3 DROP TOWER MAIN (9000 LBS)

NO. 4 4 WHIRL TOWER 100 KIAS MAIN

NO. 5 4 WHIRL TOWER 300 KIAS MAIN

NO. 6 4 DROPS FM A/C 300 KIAS AT 20,000 FT.

NO. 7 12 LIVE JUMPS

4 BY PASS OF STABILIZATION CHUTE - 6000 FT.
8 TOTAL SYSTEM 20,000 ft thru 40,000 FT.

NO. 8 3 DUMMY EJECTIONS

1 50,000 FT. AT M 1.5 - 1 SEC DELAY
1 43,000 FT. AT M 1.7 - 4 SEC DELAY (FPS)
1 13,000 FT. AT 340 KIAS

NO. 9 2 LOW & SLOW

TOTAL-45

TIME — 3 MONTHS MINIMUM
COST —

EL CENTRO TESTS

NO. 1 — 5 WHIRL TOWER 100 KIAS (SEQUENCING)

NO. 2 — 1 DROP TOWER DROGUE (7000 LBS)

NO. 3 — 1 DROP TOWER MAIN (7000 LBS)

NO. 4 — 1 WHIRL TOWER 100 KIAS (MAIN)

NO. 5 — 1 WHIRL TOWER 300 KIAS (MAIN)

NO. 6 — 3 DROPS FM A/C 300 KIAS AT 20,000 FT.

NO. 7 — 1 LIVE JUMP

NO. 8 — 2 EJECTIONS "LOW & SLOW"

PILOT PROTECTION SYSTEM

1. VISOR REFLECTANCE

   a. PRIOR ACCEPTANCE

   b. CORRECTIVE ACTION

   c. PLANNED INVESTIGATION

2. MOBILITY & COMFORT

   a. FLUCTUATION OF VENT AIR SUPPLY

   b. GLOVE LIMITATIONS

   c. HELMET WEIGHT & LEVERAGE

   d. SUIT FIT COMMENTS

3. INFLIGHT FEEDING

4. INFLIGHT RELIEF

EMERGENCY OXYGEN SUB-SYSTEM

BOTTLES

REDUCER

OFF-ON VALVES

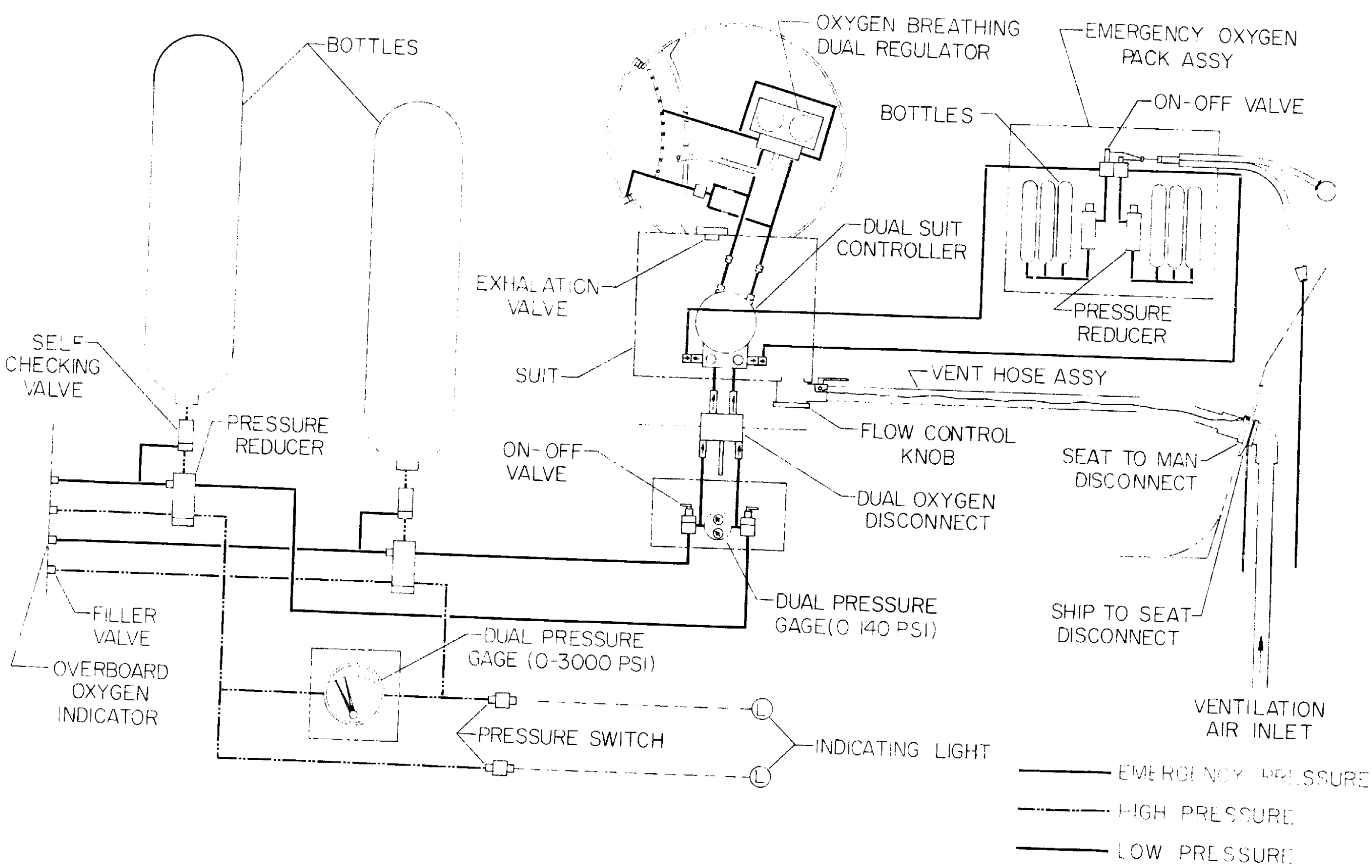
VENT AIR SUB-SYSTEM

SUIT MOUNTED VENT CONTROL VALVE

HOSE ASSEMBLY

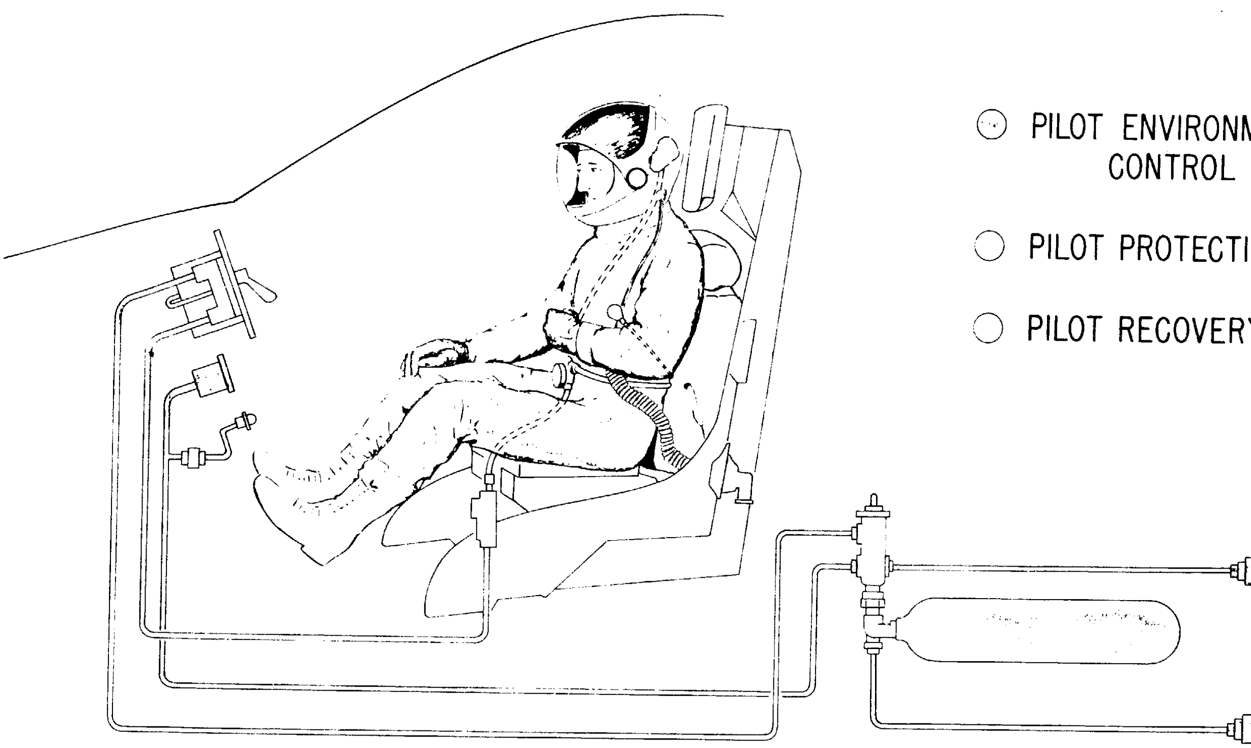
SEAT DISCONNECT

SCHEMATIC – ENVIRONMENTAL CONTROL SYSTEM



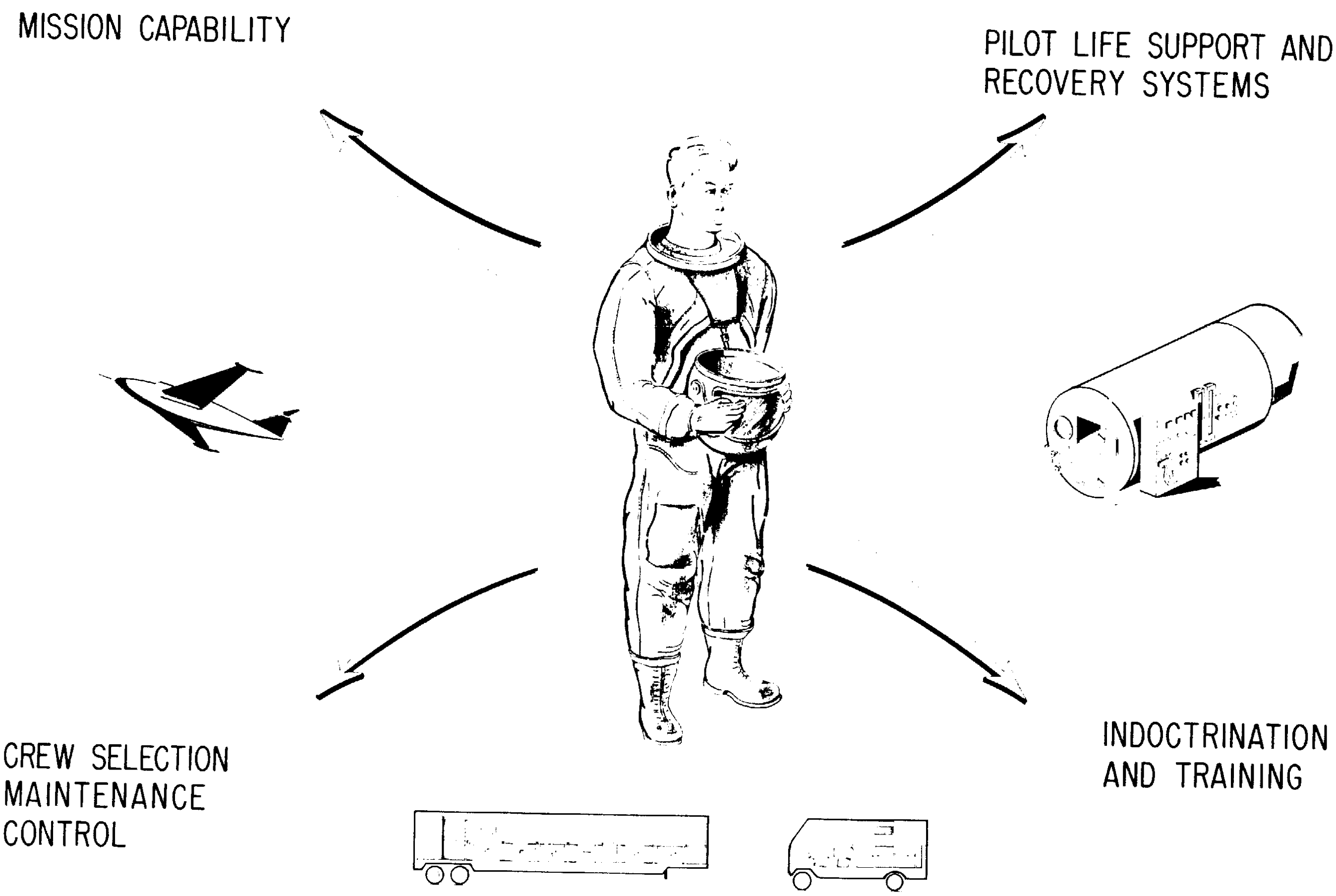
SP-139

PILOT LIFE SUPPORT & RECOVERY SYSTEMS



- PILOT ENVIRONMENTAL CONTROL SYSTEM
- PILOT PROTECTION SYSTEM
- PILOT RECOVERY SYSTEM

PILOT SAFETY AND PERFORMANCE



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PROPOSED OPERATIONAL SUIT CONFIGURATION

1. FLY MISSIONS WITH VISOR RAISED AS IN DYNASOAR SYSTEM
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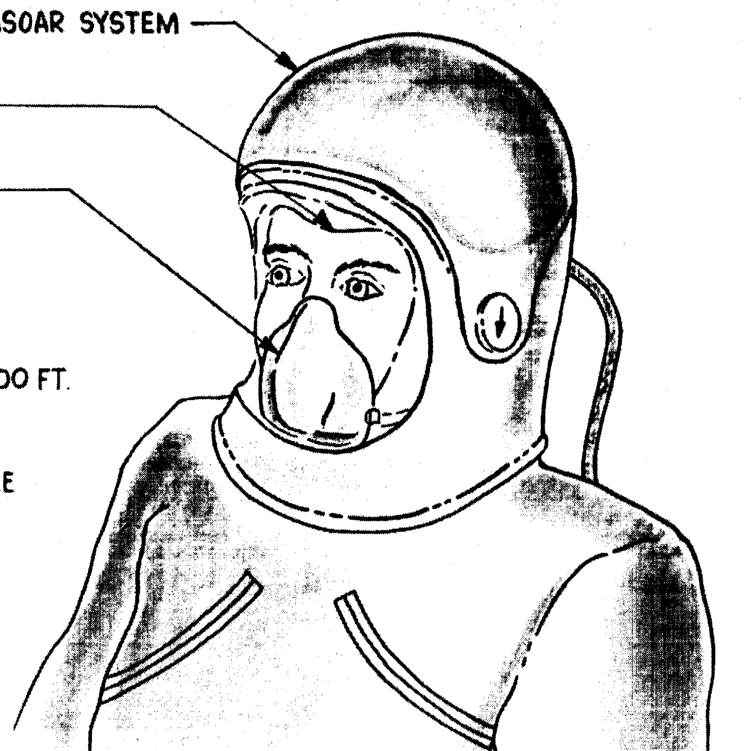

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SP-139

PARACHUTE UPDATING

ITEM THAT SHOULD BE IMPROVED	PRESENT PARACHUTE	MODIFIED PARACHUTE
● PILOT COMFORT -		
PARACHUTE TOO HEAVY	57 LBS	50 LBS
PARACHUTE HARNESS TOO BULKY	X	
CAN SOFTEN AS A RESULT OF KNOWN LOADS		X
PARACHUTE TOO THICK	6.5"	5.1"
GOOSENECKS ON SHOULDERS, ELIMINATE	TWO	
● MAINTENANCE		
THREE TIMERS AND COMPLEX CABLE ROUTING	X	
USE TWO TIMERS AND STRAIGHT CABLE PULLS		X
INTEGRAL HARNESS AND PACK	X	
PROVIDE REUSABLE HARNESS		X
● OPERATION		
TIMER POWER TO RIP CORDS	45-80#	100-150#
FREE FALL FROM DROGUE TO MAIN	1600 FT	NONE
EMERGENCY OXYGEN GAUGE IN VIEW	NONE	INCORP
ZERO LANYARD ACTUATION FORCE	10-75#	10-15#
RESCUE BEACON	NONE	INCORP

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LAHS USAF

LOW ALTITUDE HIGH SPEED
BACKGROUND - DATA

STOL (TFX) DEVELOPMENT PLAN	— April 1960
WS 324A WORK STATEMENT	— Oct 1961
TECHNICAL ANALYSIS BY SIX MAJOR CONTRACTORS	— 1960 - 61
VERTICAL ACCELERATOR - NORTH AMERICAN - [redacted]	— 1961
CORNELL FDM #325 "EFFECTS OF ATMOSPHERE TURBULENCE - LO ALTITUDE-HIGH SPEED"	— 1961
GD CONTINUED EFFORT	— 1962 to present
ASZB/ASNST-2 EXHIBIT	— Jan 1962
CORNELL FDM #343 "A TRIANGLE - FLEXIBLE AIRPLANES, ROUGH AIR AND CREW"	— May 1963
USAF AD HOC GROUP [redacted]	— Jun-Jul 1963
NASA LANGLEY - ROUGH AIR - CREW PERFORMANCE LO ALTITUDE-HIGH SPEED	— Aug 1963
NASA AMES - VERTICAL ACCELERATOR	— Jan 1964
JOURNAL OF AIRCRAFT - LOW ALTITUDE, HIGH SPEED HANDLING AND RIDING QUALITIES (NAA)	— Jan 1964

25X1A

25X1A

19Mar64

64 ASL 1025

LOW ALTITUDE HIGH SPEED
BACKGROUND - FLIGHT TEST

GD/FW	—	B-58 LOW ALTITUDE FLIGHTS - CARSWELL AFB TO EDWARDS AFB	—	1959
TAC	—	RETARDED WEAPON DELIVERY		
TAC	—	PROJECT "LITTLE BOOM"	—	Summer 1960
CORNELL	—	REPORT #116, TERRAIN AVOIDANCE SEMINAR	—	October 1961
NAVY	—	LOW ALTITUDE STUDIES - F-4 AND F-8	—	Apr-May 1963
TAC	—	PROJECT "RAPID RABBIT"	—	Sept 1963

19Mar64

B-58 LOW ALTITUDE FLIGHT FILM

GD/FW DATA ANALYSIS INDICATED:

RMS "g" AT COCKPIT	=	.15
RMS GUST VELOCITY	=	4 fps
AVERAGE MACH	=	.92
MAX GUST ENCOUNTERED		26.5 fps
FLIGHT DURATION		2 hours
ALTITUDE		100-500 Terrain Clearance
GROSS WEIGHT		155,000 - 100,000
WING LOADING		100 lbs/sq. ft - 65 lbs/sq. ft

20Mar64

LOW ALTITUDE HIGH SPEED

REQUIRED F-111A PERFORMANCE (LO-LO-HI MISSION)

M = .5	TIME 102 Min.	DISTANCE = 584 NM	ALT = 250'
M = Accel	TIME 1.8 Min.	DISTANCE = 16 NM	ALT = 250'
M = 1.2	TIME 16.2 Min	DISTANCE = 200 NM	ALT = 250'
M = .75	TIME 108 Min	DISTANCE = 800 NM	ALT = 35,000'

FUNCTION OF:

1. GUST SENSITIVITY
   - WING LOADING
   - LIFT CURVE SLOPE
   - SPEED
   - FLEXIBILITY
   - BODY BENDING

2. METEOROLOGICAL ENVIRONMENT
   - GUST VELOCITY
   - GUST FREQUENCY

3 FLIGHT CONTROL
   - AIRCRAFT SHORT PERIOD FREQUENCY
   - DAMPING RATIO
   - STICK FORCE PER "G"

64/0059

"RAPID RABBIT"

- 19 LOW ALTITUDE FLIGHTS IN F-104 AND F-105 A/C
- 9 FLIGHTS AT M.9
  - ALTITUDE 100 Ft - 500 Ft AGL
  - TIME 14-34 MIN. PER FLIGHT
- 10 FLIGHTS AT M 1.05 - M 1.15
  - ALTITUDE 100 Ft - 500 Ft
  - TIME 2-7-3/4 MIN. PER FLIGHT

"RAPID RABBIT"

STUDY CONCLUSIONS

- NAVIGATION AND AIRCRAFT CONTROL AT SUPERSONIC SPEEDS WERE WELL WITHIN PILOT CAPABILITY

- AIRCRAFT CONTROL AND HANDLING CHARACTERISTICS WERE CLEARLY BETTER AT 1.2 MACH THAN AT .9 MACH

- SOME FATIGUE WAS CAUSED BY BUFFETING DUE TO TURBULENCE.

NAVY LOW ALTITUDE FLIGHTS

F-4 AND F-8 AIRCRAFT OVER WATER

AND LAND SPEEDS OF 400 - 650

ALTITUDE 80 TO 500 FEET

64ASL-1025
19Mar64

NAVY LOW LEVEL FLIGHT TESTS

CONCLUSIONS

1. MINIMUM FEASIBLE ALTITUDE OVER LEVEL TERRAIN AT HIGH SUBSONIC SPEED IS 100 FEET.

2. MINIMUM FEASIBLE ALTITUDE OVER MOUNTAINOUS TERRAIN AT HIGH SUBSONIC SPEED IS 500 FEET

3. 5 TO 10 NM VISIBILITY REQUIRED FOR ACCURATE VISUAL NAVIGATION AT HIGH SPEED OVER STRANGE TERRAIN

4. SELF-CLOBBER FACTOR NOT CONSIDERED SERIOUS AT SPEEDS UP TO 600 (FURTHER TEST REQUIRED AT HIGHER SPEEDS)

5. DUE TO "g" FORCES AND DAMAGE TO AIRCRAFT MAXIMUM SUBSONIC SPEED AT LOW LEVEL HAS BEEN OBTAINED IN THESE TESTS.

64/0059

CORNELL AERONAUTICAL LABORATORY

FDM #343

- RMS VALUES OF "g" IN EXCESS OF .25g FOR SHORT DURATION CAN BE EXPECTED TO CAUSE DEGRADED HUMAN PERFORMANCE.

- PROBABILITY OF ENCOUNTERING TURBULENCE TO CAUSE RMS VALUES OF "g" GREATER THAN .25 IS APPROX. 1% FOR B-58, F-105 TYPE AIRCRAFT

- HIGH WING LOADING AND LOW LIFT CURVE SLOPE DECREASE SENSITIVITY TO GUSTS

- NON FLEXIBLE AIRCRAFT ARE LESS AFFECTED BY GUSTS.

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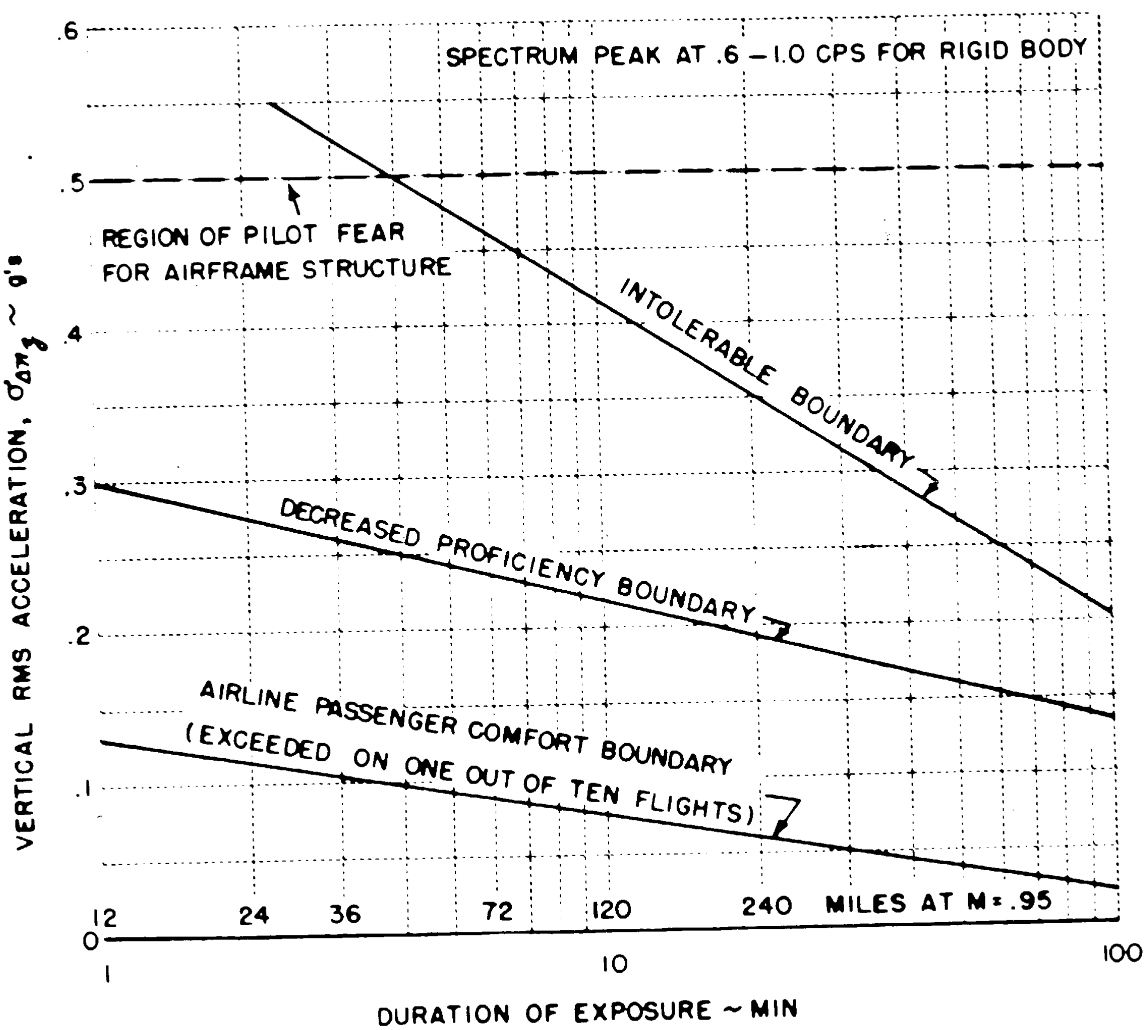
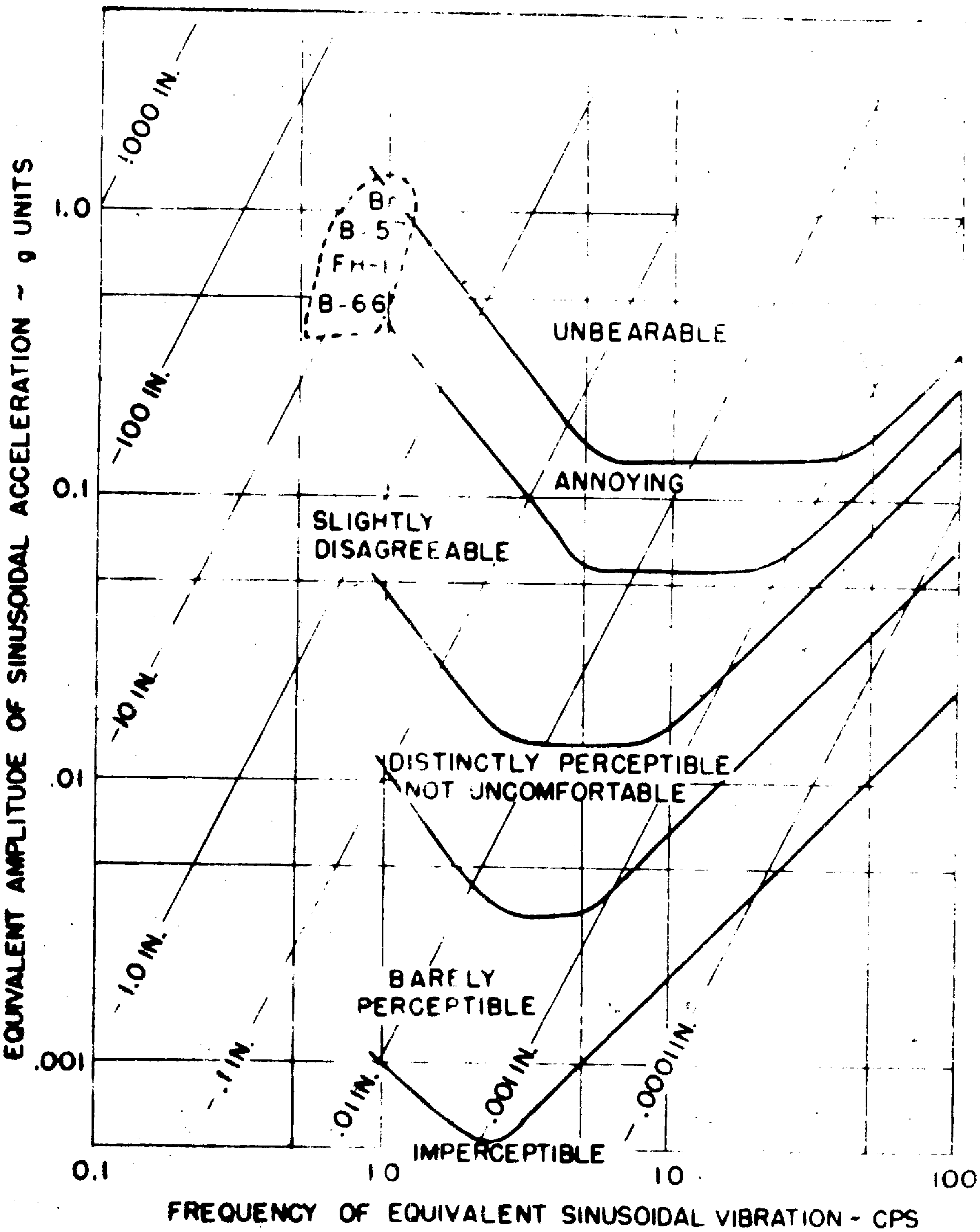


FIGURE 6 TIME-INTENSITY VIBRATION BOUNDARIES



HUMAN RATING OF VIBRATION

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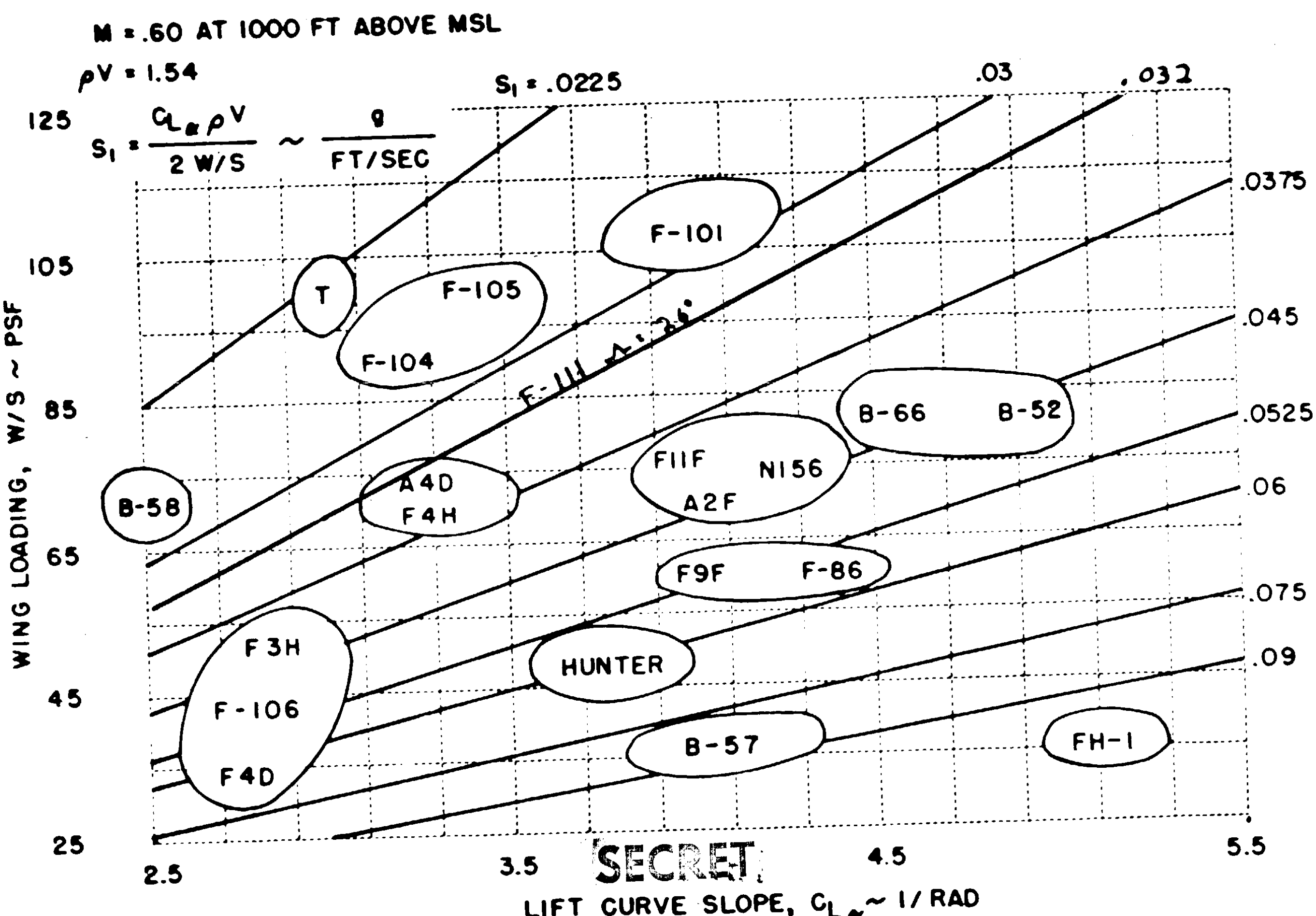

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FIGURE 4 GUST SENSITIVITY

FDM 343

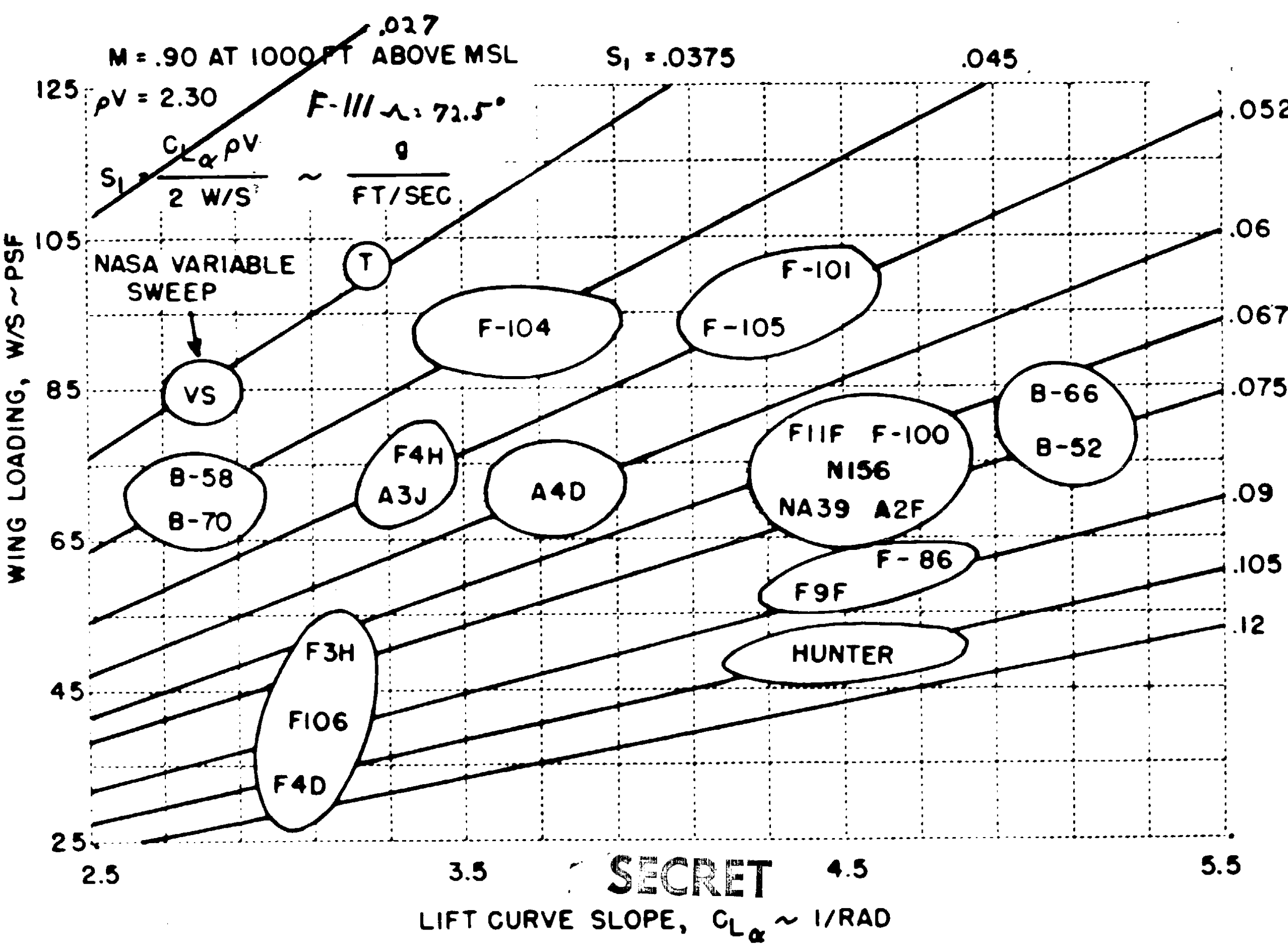

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FIGURE 5 GUST SENSITIVITY

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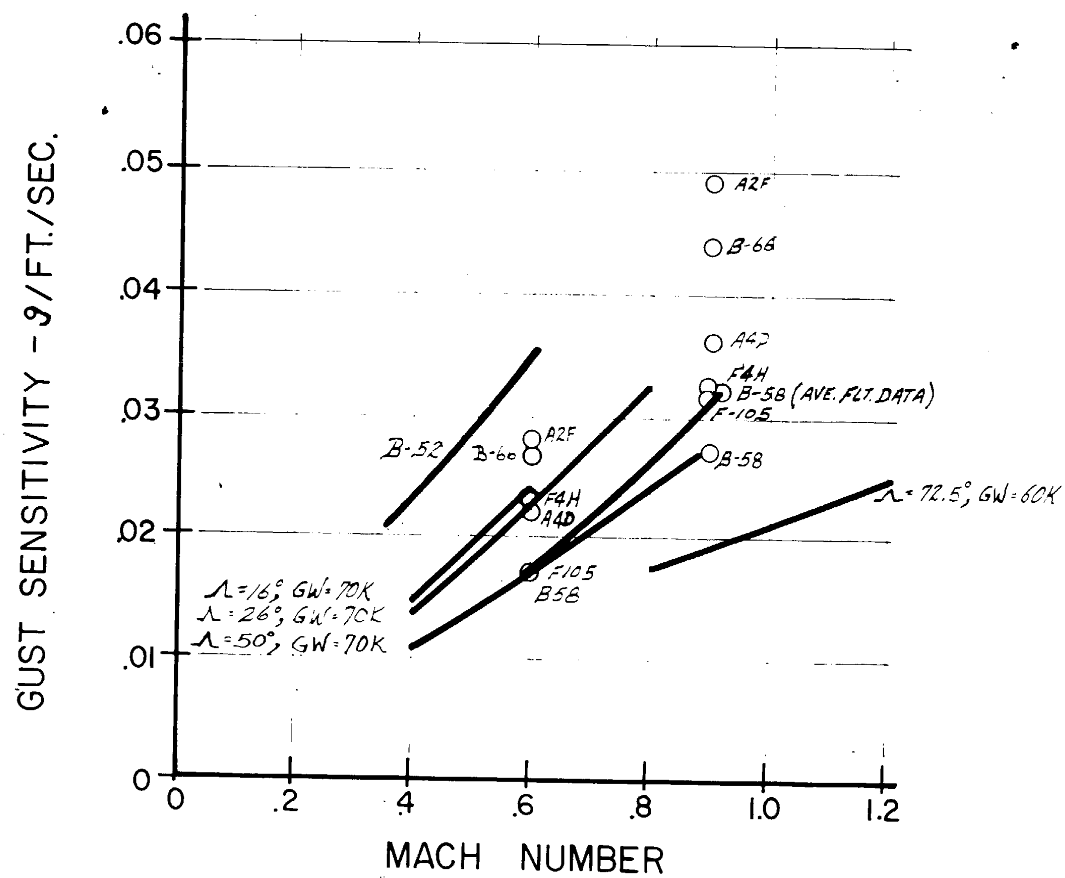
RESPONSE TO ATMOSPHERE TURBULENCE



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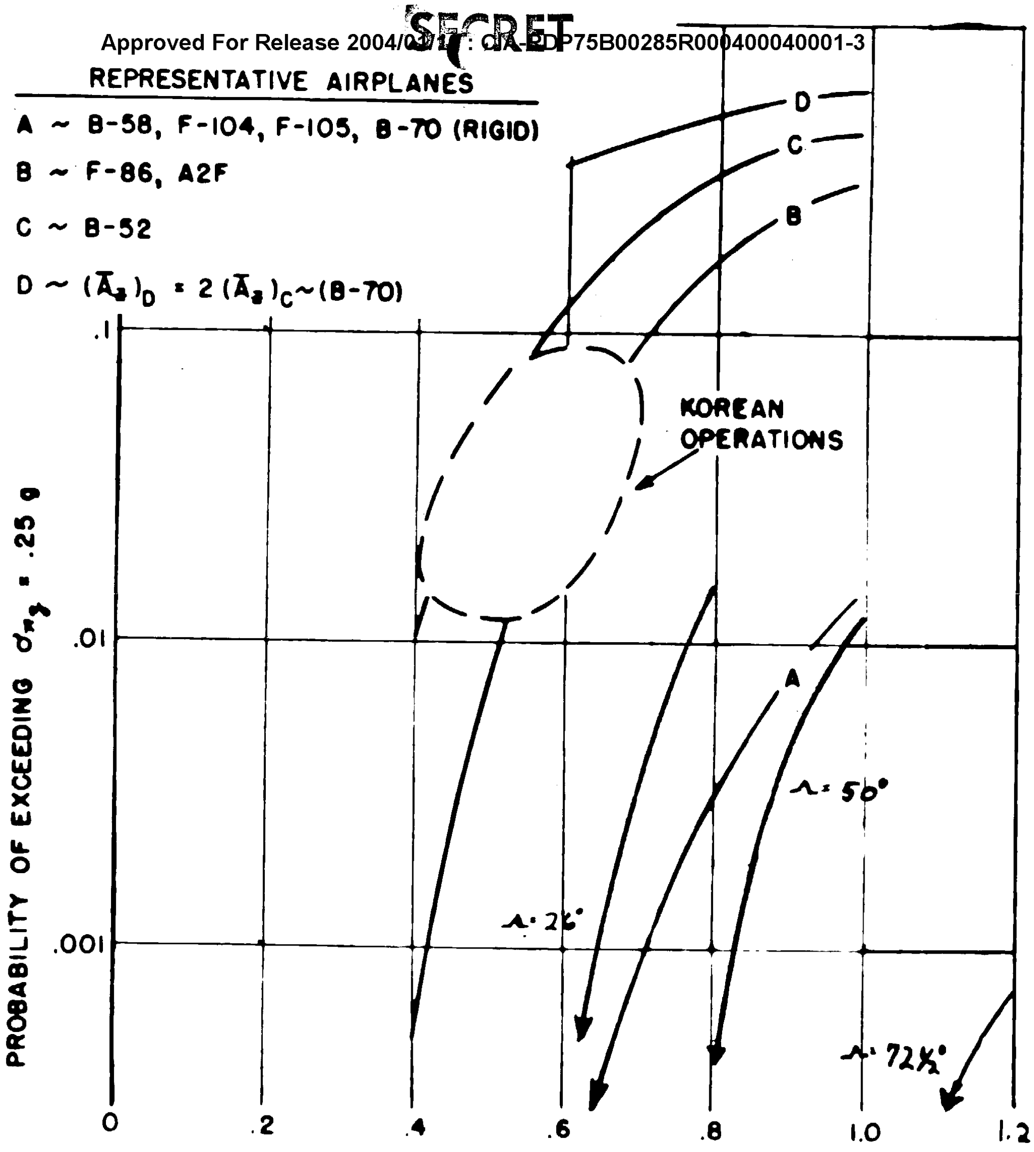
REPRESENTATIVE AIRPLANES
A ~ B-58, F-104, F-105, B-70 (RIGID)
B ~ F-86, A2F
C ~ B-52
D ~ $(\bar{A}_3)_D = 2(\bar{A}_3)_C$ ~ (B-70)
KOREAN OPERATIONS
A
B
C
D
$\Lambda = 50°$
$\Lambda = 26°$
$\Lambda = 72\frac{1}{2}°$
PROBABILITY OF EXCEEDING σ_{n_3} = .25 g
.1
.01
.001
0
.2
.4
.6
.8
1.0
1.2
MACH NO.

 64 ASL 1025

64X3571

LOW ALTITUDE HIGH SPEED AIRCRAFT FLIGHT CONTROL

SUMMARY OF STUDIES

1. HIGH NATURAL SHORT PERIOD FREQUENCY (NAA)

2. SHORT PERIOD DAMPING RATIO APPROX. .8 (CAL, STI, NAA)

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19Mar64

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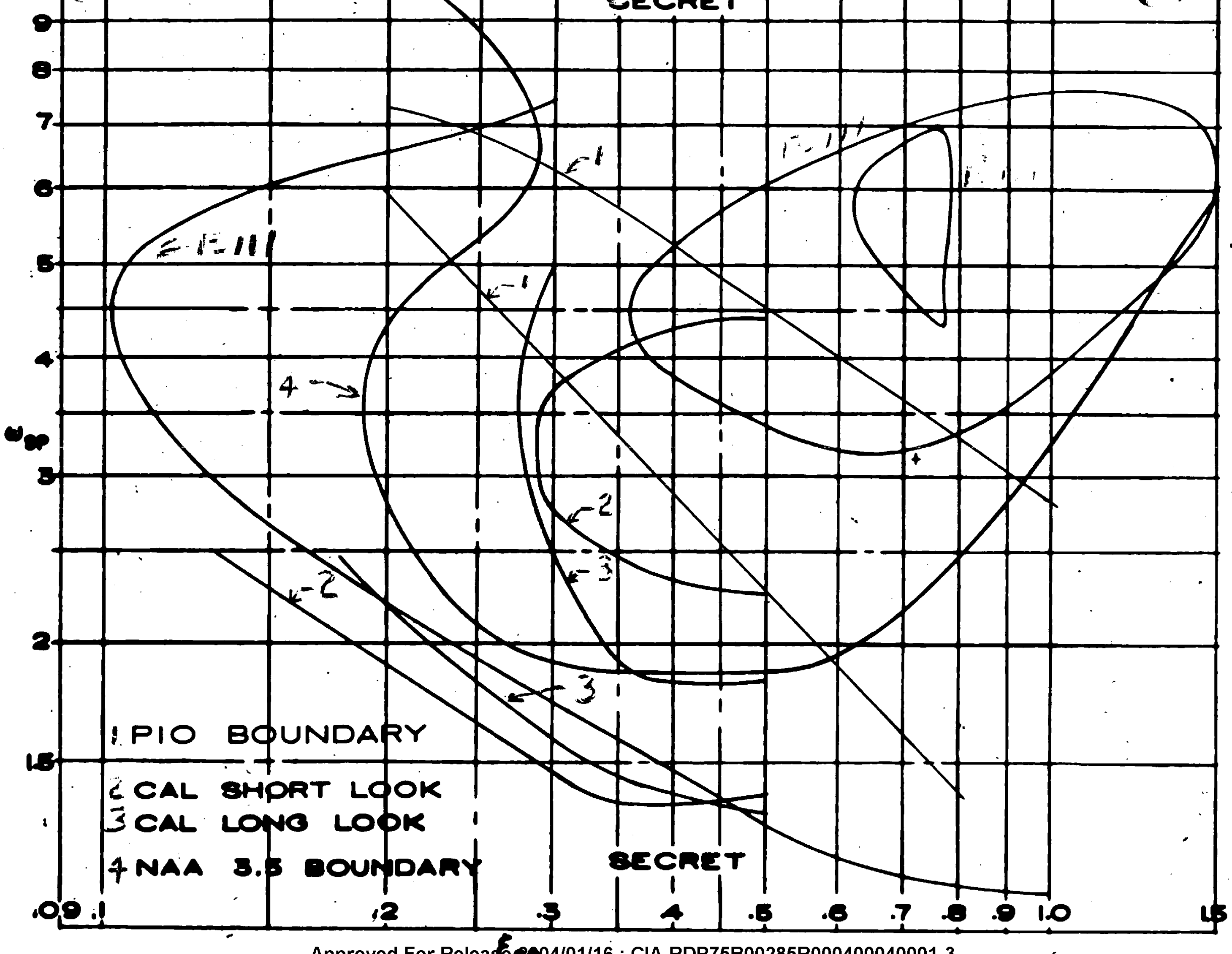

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THE F-111 PROGRAM HAS A CONTINUING EFFORT TO RE-EXAMINE AND IDENTIFY POTENTIAL PROBLEM AREAS.

UNCLASSIFIED

ADDITIONAL PROGRAMMED TESTS

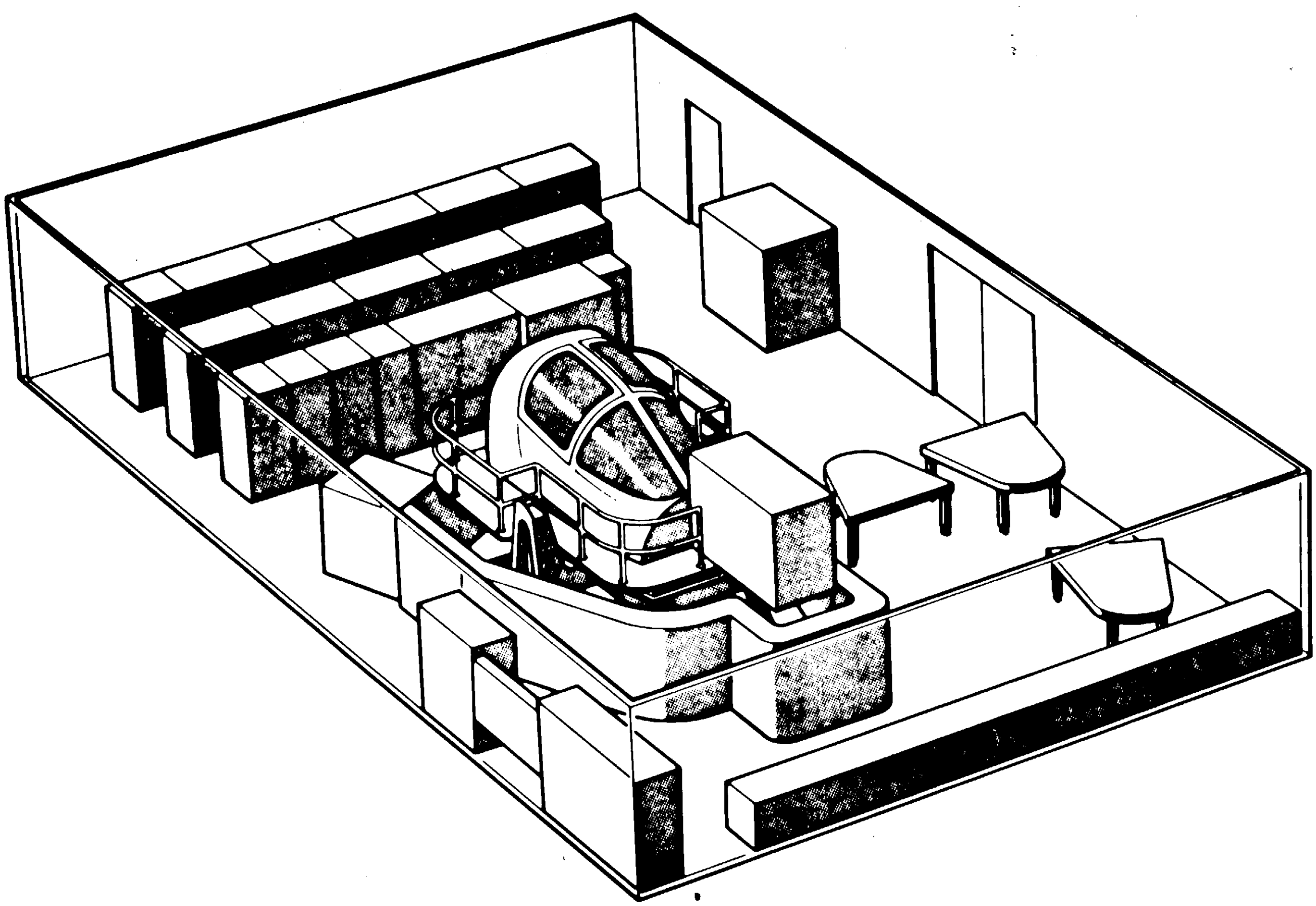
- T-29 FLIGHT TESTS
- F-106 FLIGHT TESTS
- DORA
- F-111 FLIGHT TESTS

"DORA"

- HAS COCKPIT MOTION
  - COMPLETE COCKPIT MOVES
  - MOTION WILL BE PROGRAMMED AS A FUNCTION OF GUSTS VS AERODYNAMIC CHARACTERISTICS OF F-111 AND PILOT ACTIONS

- MOTION SYSTEM CAPABILITIES
  - $\pm 9^0$ to $\pm 14^0$ ROLL $50^0/SEC^2$
  - $+14^0$ to -6^0 PITCH $30^0/SEC^2$
  - ± 12 INCHES VERTICAL DISPLACEMENT
    5 cps RESPONSE CAPABILITY
    $\pm$ 1.0 g CAPABILITY

19Mar64



ARTIST'S CONCEPTION OF THE DORA FACILITY

DYNAMIC OPERATOR RESPONSE APPARATUS

(DORA)

PURPOSES

- CREW STATION EVALUATION AND DESIGN
  - WORKLOAD DISTRIBUTION
  - CONTROL - DISPLAY RELATION
  - CONTROL ACCESSIBILITY
  - DISPLAY ADEQUACY
  - INFORMATION FLOW AND USE
- "PARTICULAR ATTENTION SHALL BE GIVEN TO HIGH SPEED, LOW LEVEL FLIGHT" (FZM-12-010, DATED 10 SEPT 62)
- EVALUATE RECOMMENDED CHANGES TO THE COCKPIT
- "PRE-FLY" CRITICAL PORTIONS OF TEST FLIGHTS
- RE-STAGE INCIDENTS OR ACCIDENTS

19Mar64

CONCLUSIONS

- AIR VEHICLE MUST BE DESIGNED TO MINIMIZE EFFECT OF LOW ALTITUDE FLIGHT

- THIS PROBLEM EXISTS FOR BOTH LOW SPEED AND HIGH SPEED FLIGHT

- A WEALTH OF BACKGROUND HAS BEEN ACCUMULATED.

- PRESENT TESTING AND ANALYSIS INDICATE ACCEPTABLE LOW ALTITUDE CHARACTERISTICS

- ADDITIONAL VERTICAL ACCELERATOR TESTS TO BE CONDUCTED AT GOVERNMENT FACILITY MAY BE DESIRABLE.

SECRET

DOWNGRADED AT 3 YEAR INTERVALS
DECLASSIFIED AFTER 12 YEARS
DOD DIR 5200.10

OXCART PROGRAM
MISCELLANCUS